



Aerospace Medicine  
and Biology  
A Continuing  
Bibliography  
with Indexes

NASA SP-7011(315)  
October 1988

(NASA-SP-7011(315)) AEROSPACE MEDICINE AND  
BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH  
INDEXES (SUPPLEMENT 315) (NASA) 71 p

N88-30281

CSCI 06E

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0166456

National Aeronautics and  
Space Administration

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Aerospace Medicine and Biology

October 1988

Pages 279-312

# **AEROSPACE MEDICINE AND BIOLOGY**

## **A CONTINUING BIBLIOGRAPHY WITH INDEXES**

**(Supplement 315)**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in September 1988 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Division 1988  
National Aeronautics and Space Administration  
Washington, DC

This supplement is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, price code A04.

# INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 211 reports, articles and other documents announced during September 1988 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects of biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1988 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

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## TYPICAL REPORT CITATION AND ABSTRACT

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ACCESSION NUMBER	→	N88-10483*#	←	CORPORATE SOURCE
TITLE	→	PREVENTION OF DISUSE OSTEOPOROSIS: EFFECT OF SODIUM FLUORIDE DURING FIVE WEEKS OF BED REST Final Report	←	PUBLICATION DATE
AUTHOR	→	VICTOR S. SCHNEIDER	←	AVAILABILITY SOURCE
REPORT NUMBERS	→	(Contract NAS9-16688) (NASA-CR-172018; NAS 1.26:172018) Avail: NTIS HC A04/MF A01 CSCL 06E	←	PRICE CODE
COSATI CODE	→	An attempt was made to modify factors which promote disuse osteoporosis and thereby prevent it from occurring. Since fluoride is currently used to enhance bone formation in the treatment of low turnover osteoporosis, it was hypothesized that if the fluoride ion was available over a long period of time that it would slow the demonstrated loss of calcium by inhibiting bone resorption and enhancing bone formation. This study was used to determine whether oral medication with sodium F will modify or prevent 5 weeks of bed rest induced disuse osteoporosis, to determine the longitudinal effects of 5 weeks of bed rest on PTH, CT and calcitriol, to measure muscle volume changes and metabolic activity by magnetic resonance imaging and magnetic resonance spectroscopy during prolonged bed rest, to measure changes in peak muscle strength and fatigability, and to measure bone turnover in bone biopsies. Subjects were studied during 1 week of equilibration, 4 weeks of control ambulation, 5 weeks of bed rest, and 1 week of reambulation. E.R.		

## TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED

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ACCESSION NUMBER	→	A88-12321*	←	AUTHOR'S AFFILIATION
TITLE	→	CONTINUOUS MONITORING OF BLOOD VOLUME CHANGES IN HUMANS	←	PUBLICATION DATE
AUTHORS	→	H. HINGHOFFER-SZALKAY and J. E. GREENLEAF (NASA, Ames Research Center, Moffett Field, CA; Graz, Universitaet, Austria)	←	
JOURNAL TITLE	→	Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Sept. 1987, p. 1003-1007. Research supported by the Oesterreichische Akademie der Wissenschaften. refs (Contract NASA TASK 199-21-12-07)	←	
		Use of on-line high-precision mass densitometry for the continuous monitoring of blood volume changes in humans was demonstrated by recording short-term blood volume alterations produced by changes in body position. The mass density of antecubital venous blood was measured continuously for 80 min per session with 0.1 g/l precision at a flow rate of 1.5 ml/min. Additional discrete plasma density and hematocrit measurements gave linear relations between all possible combinations of blood density, plasma density, and hematocrit. Transient filtration phenomena were revealed that are not amenable to discontinuous measurements. I.S.		

# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 315)*

OCTOBER 1988

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## LIFE SCIENCES (GENERAL)

**A88-41801**

**EFFECT OF CHOLINE ON THE SUPRAMOLECULAR DNA-COMPLEX OF RATS AND THEIR SURVIVAL AFTER GAMMA-IRRADIATION [DEISTVIE KHOLINA NA NADMOLEKULIARNYI KOMPLEKS DNK KRYIS I IKH VYZHIVAEMOST' PRI GAMMA-OBLUCHENII]**

N. B. STRAZHEVSKAIA and V. A. STRUCHKOV (AN SSSR, Institut Biologicheskoi Fiziki, Pushchino, USSR) Radiobiologiya (ISSN 0033-8192), vol. 28, Mar.-Apr. 1988, p. 199, 200. In Russian. refs

The effect of choline administered prior to irradiation by gamma-rays on the survival of rats and on the restoration of their tissue nuclear DNA complex was investigated. It was found that an i.v. injection of 200 mg/kg choline chloride 15 min before irradiation with a 6-Gy dose of Cs-137 increased the 30-day survival rate of rats to 50 percent (as compared to 10 percent in the control group), increased the average life span from 17.9 d to 27.5 d, and resulted in complete restoration of the elastoviscosity of DNA complexes isolated from survivors' thymus, spleen, liver, and brain 30 days after irradiation. When choline was administered immediately after irradiation, the beneficial effects were fewer, but still significant. I.S.

**A88-41802**

**EFFECT OF ADRENALINE ON THE ACTIVITY OF SUCCINATE DEHYDROGENASE IN THE PERIPHERAL BLOOD LYMPHOCYTES OF RATS AFTER EXPOSURE TO IONIZING RADIATION [VLIANIE ADRENALINA NA AKTIVNOST' SUKTSINATDEGIDROGENAZY V LIMFOTSITAKH PERIFERICHESKOI KROVI KRYIS POSLE VOZDEISTVIA IONIZIRUIUSHCHEGO IZLUCHENIIA]**

L. V. KOROLEVA and M. V. VASIN Radiobiologiya (ISSN 0033-8192), vol. 28, Mar.-Apr. 1988, p. 228-230. In Russian. refs

**A88-41803**

**THE LIPID PHASE OF BIOMEMBRANES AND THE LEVEL OF THE COMPENSATORY RESERVE IN THE CELLULAR ENERGY SYSTEM IN ANIMALS IRRADIATED DURING HYPOKINESIA [LIPIDNAIA FAZA BIOMEMBRAN I UROVEN' KOMPENSATORNOGO REZERVA ENERGETICHESKOI SISTEMY KLETKI U OBLUCHENNYKH V USLOVIAKH GIPOKINEZII ZHIVOTNYKH]**

V. I. IVANOV and A. A. TURDYEV (AN USSR, Institut Biokhimii, Tashkent, Uzbek SSR) Radiobiologiya (ISSN 0033-8192), vol. 28, Mar.-Apr. 1988, p. 245-249. In Russian. refs

**A88-41804**

**THE EFFECTS OF EXPOSURE TO LASER AND COMBINED LASER-IONIZING RADIATION ON THE TIME OF BACTERIAL CELL DIVISION [VLIANIE LAZERNOGO I KOMBINIROVANNOGO IONIZIRUIUSHCHEGO I LAZERNOGO OBLUCHENII NA SROKI DELENIIA KLETOK BAKTERII]**

N. V. SIMONIAN (Erevanskii Fizicheskii Institut, Yerevan, Armenian SSR) and K. SH. VOSKANIAN (Erevanskii Gosudarstvennyi Universitet, Yerevan, Armenian SSR) Radiobiologiya (ISSN 0033-8192), vol. 28, Mar.-Apr. 1988, p. 262-264. In Russian.

**A88-41805**

**RADIOMODIFYING EFFECTS OF QUINOLINE DERIVATIVES [RADIOMODIFITSIRUIUSHCHII EFFEKT PROIZVODNYKH KHINOLINA]**

M. V. VASIN, N. N. SUVOROV, L. A. SEMENOVA, and G. N. IL'INA Radiobiologiya (ISSN 0033-8192), vol. 28, Mar.-Apr. 1988, p. 274-276. In Russian.

The effects of 12 quinoline derivatives on the survival rate and the average lifespan of mice were investigated in animals injected i.p. with these preparations 5 to 20 min before irradiation with Co-60 (with about a 9-Gy dose). Four of these quinoline derivatives exhibited a significant radioprotective effect: 1(2-quinolyl)piperazine (quipazine), 8(1-piperazine)-1-N-pyrrolo(3,2)quinoline, and two hydrazides of piperaziny-cinchoninic acid. The protective effect of the two latter compounds was comparable to that of mexamine. I.S.

**A88-41806**

**DELAYED BEHAVIORAL STIMULATION AFTER SINGLE EXPOSURE TO MICROWAVE RADIATION [EFFEKT OTSROCHENNOI POVEDENCHESKOI AKTIVATSII PRI ODNOKRATNOM MIKROVOLNOVOM VOZDEISTVII]**

M. A. NAVAKATIKIAN and S. I. NOGACHEVSKAIA (Kievskii Nauchno-Issledovatel'skii Institut Obshchei i Kommunal'noi Gigieny, Kiev, Ukrainian SSR) Radiobiologiya (ISSN 0033-8192), vol. 28, Mar.-Apr. 1988, p. 281-283. In Russian. refs

The effect of a single 7-h-long exposure to microwave radiation (2450 MHz, 1 mW/sq cm, 0.27 mW/g) on the behavior of rats was investigated by measuring the motor activity of animals in a labyrinth in terms of general horizontal motion, directed horizontal motion, vertical motion, and integral activity index. The tests were conducted on the 1st, 2nd, and 14th day following irradiation. It was found that the exposure did not affect any of the motor activity parameters within 24 hours after irradiation. However, on the 4th day after irradiation, the values of all the measured parameters were found to be significantly elevated, as compared with preirradiation values and the nonirradiated controls. Fourteen days after irradiation the values of all the motor-activity parameters of experimental animals fell to values equal to or below those of control animals. I.S.

**A88-41825**

**THE HYPOTHALAMIC SUPRACHIASMIC NUCLEUS AS A REGULATOR OF THE CIRCADIAN SYSTEM IN MAMMALS [SUPRAKHIAZMATICHESKOE IADRO GIPOTALAMUSA KAK REGULIATOR TSIRKADIANNOI SISTEMY MLEKOPITAIUSHCHIKH]**

E. B. ARUSHANIAN, V. A. BATURIN, and A. V. POPOV

(Stavropol'skii Gosudarstvennyi Meditsinskii Institut, Stavropol, USSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 19, Apr.-June 1988, p. 67-87. In Russian. refs

The morphological and functional characteristics of the hypothalamic suprachiasmatic nuclei are discussed with special consideration given to the role of these structures, as primary oscillators, in the regulation of circadian activity in mammals. It is suggested that the suprachiasmatic nuclei obtain information concerning the outside light/darkness cycle through the retino-hypothalamic projections and can transfer this information, by means of nervous and humoral mechanisms, to the secondary oscillators, which directly regulate the period and the phase of the circadian rhythms of the behavioral, motor, and vegetative activities. The neurons of the suprachiasmatic nuclei themselves possess a circadian autorhythm, which is maintained even in isolation from the neighboring brain structures. I.S.

#### A88-43031

##### A 3,800-MILLION-YEAR ISOTOPIC RECORD OF LIFE FROM CARBON IN SEDIMENTARY ROCKS

MANFRED SCHIDLowski (Max-Planck-Institut fuer Chemie, Mainz, Federal Republic of Germany) Nature (ISSN 0028-0836), vol. 333, May 26, 1988, p. 313-318. refs (Contract DFG-SFB-73)

An increased ratio of C-12 to C-13, an indicator of the principal carbon-fixing reaction of photosynthesis, is found in sedimentary organic matter dating back to almost four thousand million years ago - a sign of prolific microbial life not long after the earth's formation. Partial biological control of the terrestrial carbon cycle must have been established very early and was in full operation when the oldest sediments were formed. Author

#### A88-43105

##### PHOTOREDUCTION OF PHEOPHYTIN IN THE PHOTOSYSTEM-II REACTION CENTERS OF GREEN ALGAE AND CYANOBACTERIA INTACT CELLS UNDER ANAEROBIC CONDITIONS (FOTOVOSSTANOVLENIE FEOFITINA V REAKTSIONNYKH TSENTRAKH FOTOSISTEMY II TSELYKH KLETOK ZELENYKH VODOROSLEI I TSIANOBAKTERII V ANAEROBNYKH USLOVIYAKH)

S. I. ALLAKHVERDIEV, V. V. KLIMOV, and V. G. LADYGIN (AN SSSR, Institut Pochvovedeniia i Fotosinteza, Pushchino, USSR) Biofizika (ISSN 0006-3029), vol. 33, May-June, 1988, p. 442-447. In Russian. refs

#### A88-43106

##### PHOTOOXIDATION OF RHODOPSIN - OXYGEN CONSUMPTION AND THE ACTION SPECTRUM [FOTOOKISLENIE RODOPSINA - RASKHOD KISLORODA I SPEKTR DEISTVIA]

A. V. STAROSTIN, I. B. FEDOROVICH, and M. A. OSTROVSKII (AN SSSR, Institut Khimicheskoi Fiziki, Moscow, USSR) Biofizika (ISSN 0006-3029), vol. 33, May-June, 1988, p. 452-455. In Russian. refs

The mechanism of photodamage inflicted upon retinal cells by visible light was investigated by examining the action spectra of the rhodopsin and membrane-lipid sulfhydryl radical oxidation and by monitoring sulfhydryl oxidation by measuring oxygen consumption. Experiments were conducted on suspensions of photoreceptive membranes from *Rana temporaria* or solutions of cysteine and trans-retinal in alcohol subjected to radiation in the 350-500 nm range. The action spectrum maxima were found to be at 380 nm for both the rhodopsin and lipid molecules, indicating that both substances were oxidized with the participation of one sensitizer. The threshold photodamage dose for the photoreceptor membrane was found to be equal to 0.1 J. Oxidation of 1 M SH was found to consume considerably less than 1 M oxygen, indicating that oxygen is not used up in the process of SH oxidation. It is suggested that the oxidation of SH radicals proceeds without participation of the singlet oxygen. I.S.

#### A88-43107

##### EFFECT OF HIGH HYDROSTATIC PRESSURE ON THE SHAPE OF HUMAN ERYTHROCYTES [VLIANIE VYSOKOGO GIDROSTATICHESKOGO DAVLENIIA NA FORMY ERITROTTSITOV CHELOVEKA]

A. A. KUZNETSOV and A. N. TERENT'EV (AN SSSR, Institut Khimicheskoi Fiziki, Moscow, USSR) Biofizika (ISSN 0006-3029), vol. 33, May-June, 1988, p. 475-478. In Russian. refs

The effect of elevated hydrostatic pressure on the shape of human erythrocytes and the dynamics of the shape changes were investigated using erythrocyte suspensions incubated in a constant-temperature pressure chamber at varying pressures ranging up to 4300 atm. It was found that erythrocytes subjected to pressures above 2600 atm exhibited irreversible shape changes and subcellular structural abnormalities. Spheroidal cells and cells resembling acanthocytes appeared at this pressure, and their proportions increased with the time of incubation, reaching the stage where spheroidal forms predominated. An equation was developed that represents the dynamics of the shape changes of pressurized red cells. I.S.

#### A88-43108

##### HEAT PRODUCTION IN MITOCHONDRIA DURING OXIDATION OF VARIOUS SUBSTRATES [TEPLOPRODUKTSIIA V MITOKHONDRII PRI OKISLENII RAZNYKH SUBSTRATOV]

M. N. KONDRASHOVA, E. V. GRIGORENKO, E. P. KHIZHNIK, and V. V. TIAZHELOV (AN SSSR, Institut Biologicheskoi Fiziki, Pushchino, USSR) Biofizika (ISSN 0006-3029), vol. 33, May-June, 1988, p. 527, 528. In Russian. refs

Heat production by mitochondrial oxidation was investigated using various oxidation substrates added to suspensions of rat liver mitochondria. Temperature profiles of the suspension surface were measured by a computerized IR thermovisor system. It was found that the oxidation of succinate produced a quick increase in temperature (with about 1 K maximum reached in 1 sec with 6 M succinate), which was about three times higher than the increases produced by oxidation of pyruvate and malate. Uncoupling of succinate oxidation by 2,4-dinitrophenol also led to a quick temperature increase. In all cases, quick local temperature rise was followed by a slow decrease. I.S.

#### A88-43419

##### ORIGIN OF THE EUKARYOTIC NUCLEUS DETERMINED BY RATE-INVARIANT ANALYSIS OF RRNA SEQUENCES

JAMES A. LAKE (California, University, Los Angeles) Nature (ISSN 0028-0836), vol. 331, Jan. 14, 1988, p. 184-186. NSF-NIH-supported research. refs

Evolutionary parsimony, a newly developed rate-invariant treeing algorithm, is used here to show that the eukaryotic ribosomal rRNA genes evolved from the eocytes, a group of extremely thermophilic, sulfur-metabolizing, anucleate cells. The deepest bifurcation yet found separates the reconstructed tree into two taxonomic divisions. These are a protoeukaryotic group (karyotes) and an essentially bacterial one (prokaryotes). Within the precision of the rooting procedure, the tree is not consistent with either the prokaryotic-eukaryotic or the archaeobacterial-eubacterial-eukaryotic groupings. It implies that the last common ancestor of extant life, and the early ancestors of eukaryotes, probably lacked nuclei, metabolized sulfur, and lived at near-boiling temperatures. C.D.

#### A88-43428

##### A PSEUDOKNOTTED RNA OLIGONUCLEOTIDE

JOSEPH D. PUGLISI, JACQUELINE R. WYATT, and IGNACIO TINCO, JR. (California, University, Berkeley) Nature (ISSN 0028-0836), vol. 331, Jan. 21, 1988, p. 283-286. NIH-DOE-supported research. refs

Evidence from single-strand specific and double-strand specific nuclease digestion is presented that a short RNA oligonucleotide adopts a stable pseudoknotted structure. The nuclease digestion and thermodynamic properties of this oligonucleotide are compared with those of oligonucleotides which form hairpin structures containing the two possible stem regions in the pseudoknot. These results show that appropriate sequences can form pseudoknots



and indicate that pseudoknots are a significant type of local tertiary structure which must be considered in the folding of complex RNA molecules. C.D.

**A88-43827**

**GENE FOR A NOVEL TRNA SPECIES THAT ACCEPTS L-SERINE AND COTRANSLATIONALLY INSERTS SELENOCYSTEINE**

WALFRED LEINFELDER, EVA ZEHELEIN, AUGUST BOECK (Muenchen, Universitaet, Munich, Federal Republic of Germany), and MARIE-ANDREE MANDRAND-BERTHELOT (Lyon, Institut National des Sciences Appliquees, Villeurbanne, France) *Nature* (ISSN 0028-0836), vol. 331, Feb. 25, 1988, p. 723-725. Research supported by the Fonds der Chemischen Industrie and DFG. refs

**A88-44215**

**EFFECT OF FOOD AND WATER DEPRIVATION ON THE STRUCTURE OF THE WAKEFULNESS-SLEEP CYCLE [VLIIANIE PISHCHEVOI I PIT'EVOI DEPRIVATSII NA STRUKTURU TSIKLA BODRSTVOVANIE-SON]**

M. G. KORIDZE and M. G. KAVKASIDZE (AN GSSR, Institut Fiziologii, Tbilisi, Georgian SSR) *Fiziologicheskii Zhurnal Kiev* (ISSN 0201-8489), vol. 34, May-June 1988, p. 17-22. In Russian. refs

The effects of food and water deprivation on the general activity of cats and on the features of their wakefulness-sleep cycle (WSC) were studied on cats fitted with brain-implanted electrodes. Food deprivation was found to result in increased excitability and restlessness as well as weight loss. On the third to fourth day of deprivation, a considerable decrease in the sleep period and an increase in the wakefulness time occurred on the third to fourth day of deprivation. Eleven-day-long food and water deprivation resulted in the disappearance of the sleep phase during the first 6 h of the cycle (i.e., the day sleep). However, the structure of the WSC in the remaining period was not changed. I.S.

**A88-44216**

**THE DYNAMICS OF VESTIBULAR NYSTAGMUS UNDER NEUROGENIC STRESS [DINAMIKA VESTIBULIARNOGO NYSTAGMA PRI NEIROGENNOM STRESSE]**

IU. L. BRONSHTAIN and V. S. RAITSES (Ivano-Frankovskii Gosudarstvennyi Meditsinskii Institut, Kiev, Ukrainian SSR) *Fiziologicheskii Zhurnal Kiev* (ISSN 0201-8489), vol. 34, May-June 1988, p. 59-63. In Russian. refs

The dynamics of vestibulosomatic and vestibulovegetative reactions under the conditions of neurogenic stress was investigated in rabbits subjected to neurogenic stress due to one-time or repeated 2-4 h long exposures to light, sound, and electrodermal stimuli administered aperiodically according to Vediaev's (1977) 'afferent stimuli conflict' scheme. Electronystagmograms were taken before and after administration of stressful stimuli while the animals were rotated in the plane parallel to that of the semicircular canals. Neurogenic stress was found to induce a change in the animals' general behavior, a relief of vestibular nystagmic reactions, and an increase of vestibular influence on the cardiovascular system, particularly pronounced under multiple exposures to stressful stimuli. I.S.

**A88-44241**

**REACTIONS OF NEURONES OF THE CENTRAL CEREBELLAR NUCLEI TO CORTICAL AND PERIPHERAL STIMULI IN ALERT CAT [REAKTSII NEIRONOV TSENTRAL'NYKH IADER MOZZHECHKA BODRSTVUIUSHCHEI KOSHKI NA KORKOVYE I PERIFERICHESKIE STIMULY]**

E. A. OGANESIAN, V. V. FANARDZHIAN, and O. A. MADATIAN (AN ASSR, Institut Fiziologii, Yerevan, Armenian SSR) *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 74, May 1988, p. 640-647. In Russian. refs

The neuronal responses of the central cerebellar nuclei to the electrical stimulation of the cerebral cortex and the electrocutaneous stimulation of the limbs were investigated in alert cats fitted with cuff electrodes and with electrodes implanted into

different cortical zones. To register neuronal reactions, the extracellular cerebellar neurons were connected to 1.0-2.0 micron-wide tungsten electrodes. The results showed that peripheral stimuli acted preferentially on the cerebellar fastigial nucleus and less so on the medial region of the lateral nucleus. The neurons of the lateral region of the lateral nucleus did not respond at all. The response of various cerebellar nuclei to stimuli from different cortical zones was also different. Thus, the neurons of the n. interpositus responded preferentially to signals from the somatosensory cortex, while neurons from the fastigial nucleus responded to the motor cortical zone and did not respond at all to stimuli from the parietal associative zone. I.S.

**A88-44242**

**MECHANISMS OF 'HEAT' TACHYCARDIA AND 'COLD' BRADYCARDIA IN CATS [MEKHANIZMY 'TEPLOVOI' TAKHIKARDII I 'KHOLODOVOI' BRADIKARDII U KOSHEK]**

G. E. SAMONINA and N. N. ABUSHINOVA (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 74, May 1988, p. 714-718. In Russian. refs

The effect of the temperature of inflowing blood on the temperature of the blood in the heart and on the heart rate was investigated in cats that were injected in the right atrium with small (1-3 ml) volumes of blood being either warmer (by 0.5-3 C) or colder (by 1-5 C) than the blood within the atrium. It was found that the infusion of warmer blood caused tachycardia in both anesthetized and alert cats, while the infusion of colder blood caused bradycardia; the infusion of blood of the same temperature as the atrium blood had no effect. Both adrenoblocking and cholinoblocking drugs were found to ameliorate the effects of warm and cold infusions. It is concluded that there exist two mechanisms regulating the reaction to temperature changes: a neurogenic mechanism that depends on the thermosensitive afferent neurons, and a myogenic one involving the reaction of the cardiac pacemaker. I.S.

**A88-44243**

**EVALUATION OF THE INFORMATION CONTENT OF RHOENCEPHALOGRAPHY BY MEANS OF INDEPENDENT RECORD CHANNELS USED TO SEPARATE THE EXTRACRANIAL AND THE INTRACEREBRAL RHEOSIGNALS [OTSENKA INFORMATIVNOSTI REOENTSEFALOGRAFII PRI RAZDELENII EKSTRAKRANIAL'NOGO I INTRATSEREBRAL'NOGO REO-SIGNALOV PO NEZAVISIMYM KANALAM ZAPISI]**

A. V. KRAMARENKO and V. N. LENCHIN (Khar'kovskii Aviatzionnyi Institut, Kharkov, Ukrainian SSR) *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 74, May 1988, p. 757-760. In Russian.

The information content of rheoencephalography (REG) was investigated by comparing intracerebral rheosignals with extracranial ones transmitted and recorded simultaneously but independently. This separation was effected by attaching electrodes from two REG leads, the frontal-mastoidal (F-M) lead (known to be specific for the intracortical blood flow) and the zygomatic-mastoidal (Z-M) lead (which was found to record only extracranial impedances) to respective skull regions. Results obtained in healthy subjects, some of whom received nitroglycerin, indicated that signals received from the F-M lead and from the Z-M lead were fully parallel, indicating that the rheoencephalograms obtained from the Z-M lead can be used to determine the shape of the rheosignal from the F-M lead (i.e., the intracortical rheosignals). I.S.

**A88-44487**

**PERIPHERAL VASCULAR RESPONSES TO HYPERTHERMIA IN THE RAT**

KEVIN C. KREGEL, P. TIMOTHY WALL, and CARL V. GISOLFI (Iowa, University, Iowa City) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, June 1988, p. 2582-2588. refs (Contract NIH-HL-32731; NIH-HL-38959)

Rats were injected with Doppler flow probes on the superior mesenteric, left iliac, or left renal, and external caudal arteries to

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study the sequence and nature of the peripheral vascular responses. The core and tail-skin temperatures, heart rate, and mean arterial blood pressure of six unanesthetized rats at 46 C and 11 chloralose-anesthetized rat at 40 C were monitored. The data collected support the hypothesis that a selective loss of compensatory splanchnic vasoconstriction may trigger the cascade of events that characterize heat stroke. This differential vascular response was similar in both unanesthetized and anesthetized animals. R.B.

**A88-44488**

### **CORONARY BLOOD FLOW RESERVE DURING +G(Z)**

#### **STRESS AND TREADMILL EXERCISE IN MINIATURE SWINE**

M. HAROLD LAUGHLIN, JOHN W. BURNS, JOHN FANTON, JOE RIPPERGER, and D. FRED PETERSON (Missouri, University, Columbia; USAF, School of Aerospace Medicine, Brooks AFB, TX; Oral Roberts University, Tulsa, OK) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, June 1988, p. 2589-2596. refs

(Contract NIH-HL-36531; F33615-85-C-4524)

The coronary blood flow reserve (CBFR) during maximal +G(z) stress is compared to the CBFR during maximal exercise stress in an experiment using miniature swine. Coronary blood flows (CBF) were determined using the microsphere technique in chronically instrumented conscious animals during both types of stress at 70-100 percent of maximum tolerance, before and after vasodilation with 1-2 mg/kg dipyridamole. During exercise at maximum oxygen consumption, dipyridamole caused a 20-30 percent increase in CBF, while during +G(z) stress, no change or coronary vasodilation was observed. Dipyridamole also produced a decreased tolerance to +G(z) stress. It is concluded that the experiment confirms that CBFR occurs during maximal exercise in normal mammals. R.B.

**A88-45414**

### **THE INHIBITION STAGE OF THE FREE-RADICAL OXIDATION OF LIPIDS PRECEDES ITS ACTIVATION STAGE UNDER STRESS [STADIJA INGIROVANIJA SVOBODNORADIKAL'NOGO OKISLENIIA LIPIDOV PREDSHESTVUET STADII EGO AKTIVATSII PRI STRESSE]**

N. V. GULIAEVA, I. P. LEVSHINA, and A. B. OBIDIN (AN SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neirofiziologii, Moscow, USSR) *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), vol. 300, no. 3, 1988, p. 748-752. In Russian. refs

Current-shock experiments performed on white rats show that the earliest response of the organism to stress is the inhibition of free-radical oxidation accompanied by the interception of superoxide radicals in the brain and blood serum. This stage is followed by the activation of free-radical oxidation. B.J.

**N88-24130#** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

### **BOTANY FACILITY PRE-PHASE C/D. CORE PAYLOAD FOR EURECA, VOLUME 2 Final Report**

Paris, France ESA 18 Nov. 1986 393 p In ENGLISH and GERMAN Sponsored in cooperation with Microtecnica, Turino, Italy; Sira Institute Ltd., Chislehurst, United Kingdom; and Bell Telephone Mfg. Co., Antwerp, Belgium (Contract ESA-6415/85-NL-PR) (BF-RP-ER-015-VOL-2; ESA-CR(P)-2510-VOL-2; ETN-88-91959) Avail: NTIS HC A17/MF A01

The Life Support Subsystem (LSS); the impact of control errors on the volume/weight demand of the ventilation and dryer; and the activities performed during the EURECA Botany Facility (BF) predevelopment phase of the LSS are presented. Methods for pollen storage and dispersal were examined. The thermal control (TC) subsystem and the heat transfer at the glass disk as well as the temperature distribution in the fluorescent tube were tested. A suitable configuration for the BF illumination system, magnetic fluid seals for the LSS and TC rotating seals, and a balancing system for the BF centrifuge were investigated. Problems of plant fixation, water supply, plant nutrients, and soil in the BF are treated. The study and distribution of plant nutrients, and the removal of

phytotoxins in the BF are outlined.

ESA

**N88-24134#** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

### **EXAMINATION OF METHODS FOR POLLEN STORAGE AND DISPERSAL**

K. LOETZERICH and H. LOESER *In its Botany Facility Pre-Phase C/D Core Payload for EURECA, Volume 2* 19 p 18 Nov. 1986 (TN-RB524-097/86) Avail: NTIS HC A17/MF A01

Methods to store pollens and to dispose of them when pollination is accomplished were examined. The likely basic requirements which a Pollen Storage And Dispersal Device (PSADD) has to meet were compiled, and features of pollen were identified. The pollination methods are discussed, and two PSADD options are described. The preferred option consists of a storage volume formed by a duct and a cylindrical membrane that is opened electrically when pollination has to be initiated. The air flow of the life support system can carry the pollen away and distribute them in the cuvette. It is recommended to review the proposed concept and to test it in a model cuvette of the laboratory model in order to confirm its feasibility. ESA

**N88-24141#** Sira Inst. Ltd., Chislehurst (England).

### **BOTANY FACILITY: PROBLEMS OF WATER SUPPLY, PLANT NUTRIENTS AND SOIL IN THE BOTANY FACILITY**

*In MBB GmbH, Botany Facility Pre-Phase C/D Core Payload for EURECA, Volume 2* 6 p 18 Nov. 1986 (SIRA-A/7373/WP220/RJS/003) Avail: NTIS HC A17/MF A01

The major points to be considered in providing the correct environment for plant roots in the EURECA Botany Facility (BF) are treated. The term soil describes the medium in which the roots propagate. In relation with water supply the principle of water recycling in the cuvettes, the automatic centrifuge balancing system, the water storage problem, the water distribution system, and the seed storage conditions are discussed. The main problems associated with substrates for plant growth are outlined. The problem of maintaining supplies of nutrients to the plant throughout its life under BF conditions is discussed. ESA

**N88-24142#** Sira Inst. Ltd., Chislehurst (England). Research and Development Div.

### **SUPPLY AND DISTRIBUTION OF PLANT NUTRIENTS IN THE BOTANY FACILITY**

R. J. SIMPSON *In MBB GmbH, Botany Facility Pre-Phase C/D Core Payload for EURECA, Volume 2* 9 p 18 Nov. 1986 (SIRA-A/7373/WP220/RJS/004) Avail: NTIS HC A17/MF A01

The adequate supply of nutrients and trace elements required for plants grown in the EURECA Botany Facility (BF) to reach maturity and to generate new seeds is discussed. The delivery of soluble nutrients to plant roots at the required concentrations is a key factor in BF experiments. It is desirable that similarity between zero and microgravity samples be maintained in this respect. Nutrient delivery by passive and active means is discussed. Active (pumped) delivery and feedback control is probably best, although the most complex option. The use of nonspecific measurements, such as electrical conductivity for control is probably feasible in the context of BF, but the use of specific chemical sensors is probably not a viable option at present. The use of porous materials as plant substrates and for water storage is discussed. ESA

**N88-24144#** Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

### **BOTANY FACILITY PRE-PHASE C/D. CORE PAYLOAD FOR EURECA, VOLUME 1 Final Report**

Paris, France ESA 29 Apr. 1987 231 p Prepared in cooperation with Microtecnica, Turino, Italy; Sira Institute Ltd., Chislehurst, United Kingdom; and Bell Telephone Mfg. Co., Antwerp, Belgium (Contract ESA-6415/85-NL-PR) (BF-RP-ER-015-VOL-1; ESA-CR(P)-2510-VOL-1; ETN-88-91958) Avail: NTIS HC A11/MF A01

The EURECA botany facility design definition and interfaces,

and testing of the centrifuge and a laboratory model are described. The facility is a multiuser life sciences facility intended to support specific botanical investigations during the lower orbital missions of EURECA. The experiments proposed for the first mission are concerned with plants, fungi, and insects and these factors drive the design of the facility presented. The major aim of the scientific experimentation is to investigate the behavior of the biological samples under microgravity conditions and to compare it with that shown by similar samples accommodated on the on-board 1 g reference centrifuge. Near terrestrial conditions are simulated within the facility with respect to sample atmospheric conditions, pressure, and humidity. The facility also provides samples with near terrestrial condition with respect to water and nutrient supplies, and a suitable diurnal illumination. ESA

**N88-24145\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**SPACE STATION HUMAN FACTORS RESEARCH REVIEW. VOLUME 1: EVA RESEARCH AND DEVELOPMENT**

MARC M. COHEN, ed. and H. C. VYKUKAL, ed. Apr. 1988 136 p Workshop held at Moffett Field, Calif., 3-6 Dec. 1985 (NASA-CP-2426-VOL-1; A-87163-VOL-1; NAS 1.55:2426-VOL-1) Avail: NTIS HC A07/MF A01 CSCL 06B

An overview is presented of extravehicular activity (EVA) research and development activities at Ames. The majority of the program was devoted to presentations by the three contractors working in parallel on the EVA System Phase A Study, focusing on Implications for Man-Systems Design. Overhead visuals are included for a mission results summary, space station EVA requirements and interface accommodations summary, human productivity study cross-task coordination, and advanced EVAS Phase A study implications for man-systems design. Articles are also included on subsea approach to work systems development and advanced EVA system design requirements.

**N88-24146\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**SUBSEA APPROACH TO WORK SYSTEMS DEVELOPMENT**

M. L. GERNHARDT, F. R. FRISBIE, and C. E. BROWN *In its* Space Station Human Factors Research Review. Volume 1: EVA Research and Development p 69-84 Apr. 1988 Sponsored by Oceanengineering International Avail: NTIS HC A07/MF A01 CSCL 05H

Self-contained undersea working environments with applications to space station EVA environments are discussed. Physiological limitations include decompression, inert gas narcosis, high-pressure nervous system, gas toxicity, and thermal limitations. Work task requirements include drilling support, construction, inspection, and repair. Work systems include hyperbaric diving, atmospheric work systems, tele-operated work systems, and hybrid systems. Each type of work system is outlined in terms of work capabilities, special interface requirements, and limitations. Various operational philosophies are discussed. The evolution of work systems in the subsea industry has been the result of direct operational experience in a competitive market. J.P.B.

**N88-24148\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**SPACE STATION HUMAN FACTORS RESEARCH REVIEW. VOLUME 4: INHOUSE ADVANCED DEVELOPMENT AND RESEARCH**

TRIEVE TANNER, ed., YVONNE A. CLEARWATER, ed., and MARC M. COHEN, ed. May 1988 135 p Workshop held at Moffett Field, Calif., 3-6 Dec. 1985 (NASA-CP-2426-VOL-4; A-87247-VOL-4; NAS 1.55:2426-VOL-4) Avail: NTIS HC A07/MF A01 CSCL 06B

A variety of human factors studies related to space station design are presented. Subjects include proximity operations and window design, spatial perceptual issues regarding displays, image management, workload research, spatial cognition, virtual interface, fault diagnosis in orbital refueling, and error tolerance and procedure aids.

**N88-24155\*** Lockheed Engineering and Management Services Co., Inc., Washington, D.C.

**USSR SPACE LIFE SCIENCES DIGEST, ISSUE 17**

LYDIA RAZRAN HOOKE, ed., RONALD TEETER, ed., VICTORIA GARSHNEK, ed., and JOSEPH ROWE, ed. (Library of Congress, Washington, D. C.) Washington NASA Jun. 1988 126 p (Contract NASW-4292) (NASA-CR-3922(20); NAS 1.26:3922(20)) Avail: Issuing Activity CSCL 06C

This is the seventeenth issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 62 papers published in Russian language periodicals or presented at conferences and of 3 new Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. The abstracts included in this issue have been identified as relevant to 33 areas of space biology and medicine. These areas are: adaptation, biological rhythms, biospherics, body fluids, botany, cardiovascular and respiratory systems, cytology, cosmonaut training, developmental biology, endocrinology, enzymology, equipment and instrumentation, exobiology, gastrointestinal system, genetics, habitability and environmental effects, hematology, human performance, immunology, life support systems, man-machine systems, mathematical modeling, metabolism, microbiology, musculoskeletal system, neurophysiology, nutrition, operational medicine, perception, personnel selection, psychology, radiobiology, and reproductive biology. Author

**N88-24156\*#** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

**SOIL EROSION AND CAUSATIVE FACTORS AT VANDENBERG AIR FORCE BASE, CALIFORNIA**

JOEL B. BUTTERWORTH (Bionetics Corp., Cocoa Beach, Fla.) Mar. 1988 51 p (Contract NAS10-10285) (NASA-TM-100981; NAS 1.15:100981) Avail: NTIS HC A04/MF A01 CSCL 13B

Areas of significant soil erosion and unvegetated road cuts were identified and mapped for Vandenberg Air Force Base. One hundred forty-two eroded areas (most greater than 1.2 ha) and 51 road cuts were identified from recent color infrared aerial photography and ground truthed to determine the severity and causes of erosion. Comparison of the present eroded condition of soils (as shown in the 1986 photography) with that in historical aerial photography indicates that most erosion on the base took place prior to 1928. However, at several sites accelerated rates of erosion and sedimentation may be occurring as soils and parent materials are eroded vertically. The most conspicuous erosion is in the northern part of the base, where severe gully, sheet, and mass movement erosion have occurred in soils and in various sedimentary rocks. Past cultivation practices, compounded by highly erodible soils prone to subsurface piping, are probably the main causes. Improper range management practices following cultivation may have also increased runoff and erosion. Aerial photography from 1986 shows that no appreciable headward erosion or gully sidewall collapse have occurred in this area since 1928. Author

**N88-24157\*#** Maryland Univ., Baltimore. Dept. of Neurology.

**EVALUATION OF THE ENDOGENOUS GLUCOCORTICOID HYPOTHESIS OF DENERVATION ATROPHY**

MASAAKI KONAGAYA, YOKO KONAGAYA, and STEPHEN R. MAX 1988 13 p (Contract NAG2-100) (NASA-CR-182848; NAS 1.26:182848; REPT-191/86) Avail: NTIS HC A03/MF A01 CSCL 06B

The effects are studied of the oral administration of RU38486, a potent selective glucocorticoid antagonist, on muscle weight, non-collagen protein content, and selected enzyme activities (choline acetyltransferase, glucose 6-phosphate dehydrogenase, and glutamine synthetase) following denervation of rat skeletal muscle. Neither decreases in muscle weight, protein content, and choline acetyltransferase activity, nor increases in the activities of glucose 6-phosphate dehydrogenase and glutamine synthetase

were affected by RU38486. These data do not support the hypothesis that denervation atrophy results from enhanced sensitivity of muscle to endogenous glucocorticoids. Author

**N88-25128#** School of Aerospace Medicine, Brooks AFB, Tex.  
**BEHAVIORAL RESPONSE OF RATS EXPOSED TO HIGH-POWER MICROWAVE RADIATION Interim Report, Sep. 1986 - Jan. 1987**

ROBERT E. CORDTS, JAMES H. MERRITT, DAVID N. ERWIN, KENNETH A. HARDY, and MICHAEL G. YOCHMOWITZ Feb. 1988 29 p  
 (AD-A192199; USAFSAM-TR-87-30) Avail: NTIS HC A03/MF A01 CSCL 06G

Emerging high-power microwave technologies require that bioeffects of exposure to this type of radiation be investigated for health and safety considerations. Disruption of animal behavior is reported to be a sensitive indicator of microwave exposure. Three behavioral tasks were chosen for this initial investigation of exposure to U.S. Air Force high-power microwave emitters. The tasks were: (1) single trail avoidance, (2) water satiation, and (3) rotarod performance. Exposure to high-power microwave radiation from the USAFSAM peak power simulator significantly affected the single trail avoidance task. Neither the single trail avoidance task nor rotarod performance was affected by the Gypsy emitter. However, animals exposed to 9 kW and 11 kW outputs from the USAFSAM emitter spent significantly less time imbibing water postexposure than sham-exposed animals. The most consistent finding in the animals exposed to the Gypsy pulses was that those exposed at 4 m (13.1 ft) spent significantly less time drinking water than those exposed at 1 m (3.28 ft). This paradoxical result may be due to the complex shape of the Gypsy pulse. These data are from the first studies in a series of bioeffects studies of high-power microwave exposure. Other bioeffects investigations using these sources are under way. GRA

**N88-25129\*#** Maryland Univ., Baltimore. Dept. of Neurology.  
**DEXAMETHASONE REGULATES GLUTAMINE SYNTHETASE EXPRESSION IN RAT SKELETAL MUSCLES**

STEPHEN R. MAX, MASAOKI KONAGAYA, YOKO KONAGAYA, JOHN W. THOMAS, CARL BANNER, and LJUBISA VITKOVIC (National Inst. of Health, Bethesda, Md.) 1986 23 p  
 (Contract NAG2-100)  
 (NASA-CR-182935; NAS 1.26:182935) Avail: NTIS HC A03/MF A01 CSCL 06B

The regulation of glutamine synthetase by glucocorticoids in rat skeletal muscles was studied. Administration of dexamethasone strikingly enhanced glutamine synthetase activity in plantaris and soleus muscles. The dexamethasone-mediated induction of glutamine synthetase activity was blocked to a significant extent by orally administered RU38486, a glucocorticoid antagonist, indicating the involvement of intracellular glucocorticoid receptors in the induction. Northern blot analysis revealed that dexamethasone-mediated enhancement of glutamine synthetase activity involves dramatically increased levels of glutamine synthetase mRNA. The induction of glutamine synthetase was selective in that glutaminase activity of soleus and plantaris muscles was not increased by dexamethasone. Furthermore, dexamethasone treatment resulted in only a small increase in glutamine synthetase activity in the heart. Accordingly, there was only a slight change in glutamine synthetase mRNA level in this tissue. Thus, glucocorticoids regulate glutamine synthetase gene expression in rat muscles at the transcriptional level via interaction with intracellular glutamine production by muscle and to mechanisms underlying glucocorticoid-induced muscle atrophy.

Author

**N88-25130#** Rouen Univ. (France). Lab. de Toxicologie.  
**EVALUATION OF THE TOXICITY OF PRODUCTS FROM THE THERMAL DEGRADATION OF MATERIALS Final Report [EVALUATION DE LA TOXICITE DES PRODUITS DE DEGRADATION THERMIQUE DES MATERIAUX]**

J. M. JOUANY and M. GUERBET Feb. 1987 197 p In

FRENCH

(Contract DRET-84-044)

(ETN-88-91995) Avail: NTIS HC A09/MF A01

Thermal decomposition risk on 15 materials selected using inflammability and toxicity criteria was studied. The experimental procedure included biological measurement on rats (mortality, injury). The results were treated using multivariate analysis in order to define categories of variables and materials. The analysis of ventilation effects shows that the concentration parameter (g/cm<sup>3</sup>) is a realistic parameter. ESA

**N88-25131#** Los Alamos National Lab., N. Mex.

**THE HUMAN GENOME: COMPUTATIONAL CHALLENGES**

G. I. BELL Feb. 1988 19 p Presented at the 3rd International Conference on Supercomputing, Boston, Mass., 15 May 1988 (Contract W-7405-ENG-36)

(DE88-006465; LA-UR-88-450; CONF-880567-2) Avail: NTIS HC A03/MF A01

The deoxyribonucleic acid (DNA) of a human cell contains all the information required for specifying that cell, or indeed the whole person, and constitutes the human genome. Programs are now under way to obtain genetic linkage maps and physical maps of human chromosomes containing the DNA, and large scale efforts will soon begin to provide detailed sequences. The challenges involved in assembling these data into a knowledge base are examined. Computations will play a key role in enabling the scientists to understand the information contained in sequence data. Pattern recognition and string matching algorithms will be of particular importance. Recent results in the use of adaptive networks for pattern detection will be presented. DOE

**N88-25132#** Oak Ridge National Lab., Tenn.

**ECOLOGICAL RISK FACTORS RELATED TO ENVIRONMENTAL USES OF GENETICALLY ENGINEERED ORGANISMS**

F. E. SHARPLES 1987 29 p Presented at the Meeting on Bioaugmentation as a Means to Enhanced Waste Treatment, New Orleans, La., 30 Aug. 1987 (Contract DE-AC05-84OR-21400)

(DE88-006674; CONF-8708224-1) Avail: NTIS HC A03/MF A01

The purpose of this paper is to discuss some of the ecological questions and concerns related to environmental applications of biotechnology. There are a number of uncertainties about the risks entailed in the use of such products. These uncertainties arise principally because of gaps in the knowledge bases in basic ecology, microbial biology and ecology, genetics, and risk assessment. The need to ensure that the benefits of biotechnology products are safely realized and that their environmental applications do not result in new sources of environmental degradation provides the fundamental rationale for systematic assessments of risk before field testing or commercial use. DOE

**N88-25133\*#** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

**MONITORING BIOLOGICAL IMPACTS OF SPACE SHUTTLE LAUNCHES FROM VANDENBERG AIR FORCE BASE: ESTABLISHMENT OF BASELINE CONDITIONS**

PAUL A. SCHMAIZER and C. ROSS HINKLE (Bionetics Corp., Cocoa Beach, Fla.) Dec. 1987 100 p  
 (NASA-TM-100982; NAS 1.15:100982) Avail: NTIS HC A05/MF A01 CSCL 06C

Space shuttle launches produce environmental impacts resulting from the formation of an exhaust cloud containing hydrogen chloride aerosols and aluminum oxide particulates. Studies have shown that most impacts occur near-field (within 1.5 km) of the launch site while deposition from launches occurs far-field (as distant as 22 km). In order to establish baseline conditions of vegetation and soils in the areas likely to be impacted by shuttle launches from Vandenberg Air Force Base (VAFB), vegetation and soils in the vicinity of Space Launch Complex-6 (SLC-6) were sampled and a vegetation map prepared. The areas likely to be impacted by launches were determined considering the structure of the launch complex, the prevailing winds, the

terrain, and predictions of the Rocket Exhaust Effluent Diffusion Model (REEDM). Fifty vegetation transects were established and sampled in March 1986 and resampled in September 1986. A vegetation map was prepared for six Master Planning maps surrounding SLC-6 using LANDSAT Thematic Mapper imagery as well as color and color infrared aerial photography. Soil samples were collected from the 0 to 7.5 cm layer at all transects in the wet season and at a subsample of the transects in the dry season and analyzed for pH, organic matter, conductivity, cation exchange capacity, exchangeable Ca, Mg, Na, K, and Al, available NH<sub>3</sub>-N, PO<sub>4</sub>-P, Cu, Fe, Mn, Zn, and TKN. Author

**N88-25134\*** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

#### **HISTORY OF WILDLAND FIRES ON VANDENBERG AIR FORCE BASE, CALIFORNIA**

DIANA E. HICKSON (Bionetics Corp., Cocoa Beach, Fla.) Mar. 1988 39 p

(Contract NAS10-10285)

(NASA-TM-100983; BIO-1; NAS 1.15:100983) Avail: NTIS HC A03/MF A01 CSCL 06C

The fire history of the past 50 years for Vandenberg AFB, California was determined using aerial photography, field investigation, and historical and current written records. This constitutes a record of the vegetation age classes for the entire base. The location, cause, and fuel type for sixty fires from this time period were determined. The fires were mapped and entered into a geographic information system (GIS) for Vandenberg. Fire history maps derived from this GIS were printed at 1:9600 scale and are on deposit at the Vandenberg Environmental Task Force Office. Although some ecologically significant plant communities on Vandenberg are adapted to fire, no natural fire frequency could be determined, since only one fire possibly caused by lightning occurred in the area now within the base since 1937. Observations made during this study suggest that burning may encourage the invasion of exotic species into chaparral, in particular Burton Mesa or sandhill chaparral, an unusual and geographically limited form of chaparral found on the base. Author

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### AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

**A88-43101**

#### **ENDOCRINAL REGULATION DURING VARIOUS PATHOLOGICAL CONDITIONS AND UNDER THE INFLUENCE OF EXTREME FACTORS [ENDOKRINNAIA REGULIATSIIA PRI RAZLICHNYKH PATOLOGICHESKIKH SOSTOIANIIAKH I VOZDEISTVII EKSTREMAL'NYKH FAKTOROV]**

G. M. IAKOVLEV, V. I. MAZUROV, V. A. IAKOVLEV, A. L. RAKOV, K. V. KULAGIN et al. Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), April 1988, p. 35-37. In Russian. refs

The hormonal responses of humans to stressful pathological conditions such as severe burns, mechanical trauma, and myocardial infarct and to environmental stress, such as physical loads, hypodynamia, high altitude, and high-latitude climate, were investigated. Hormonal changes were determined by periodically measuring (using radioimmunoassays) blood concentrations of various hormones during stress and after the removal of stressful conditions. It was found that both physical and environmental stress factors acted by increasing the activity of the hypothalamic-hypophyseal-adrenal system and decreasing the activity of the hypothalamic-hypophyseal-gonadal system, although the degree of hormonal changes varied with the type of stress. Maximal deviations were observed during life-threatening stress such as

mechanical trauma and severe burns. Moreover, the hormonal deviations lingered for some time after the removal of stress. I.S.

**A88-43102**

#### **A METHOD FOR INCREASING THE WORK CAPACITY OF OPERATORS IN HOT CLIMATE [SPOSOB POVYSHENIIA RABOTOSPOSOBNOSTI OPERATOROV V USLOVIAKH ZHARKOGO KLIMATA]**

A. Z. SLOBODIN, A. P. BORODAI, S. S. MARKEEVA, R. I. LIUBOMIRSKAIA, and N. N. KOVEROVA Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), April 1988, p. 44-46. In Russian. refs

This paper describes the effect of a training method, which involves breathing through the complementary pulmonary volume (CPV), on the work capacity of humans. The breathing exercises acted to produce hypoxic-hypercapnic conditions concurrent with respiratory resistance. It was found that, after 20 days of exercises, subjects were able to increase their work capacity, measured using the PWC(170) test, by 12.8 percent in comparison with the pretraining values. Trained subjects also exhibited improvements in audiomotor and videomotor reactions and in the feeling of general well-being. I.S.

**A88-43103**

#### **SOME OPHTHALMOLOGICAL PROBLEMS ENCOUNTERED IN THE PRACTICE OF AVIATION MEDICINE [NEKOTORYE VOPROSY OFTAL'MOLOGII V PRAKTIKE VRACHEBNO-LETNOI EKSPERTIZY]**

L. M. ASYEV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), April 1988, p. 48, 49. In Russian.

Consideration is given to the possibility of misdiagnosis of some ophthalmological conditions in flight personnel and to the need of quick diagnosis upon the original complaint. Examples are presented illustrating the consequences of an original misdiagnosis or a delay in treatment. Specific recommendations are presented for aviation ophthalmologists concerning the frequency and the scope of periodic eye examinations for individual pilots with and without corrected vision, as well as for physicians concerning examination, maintenance, and training of eyesight. I.S.

**A88-43104**

#### **EVALUATION OF PHYSICAL WORK CAPACITY IN CONDITIONS OF HYPOKINESIA [OTSENKA FIZICHESKOI RABOTOSPOSOBNOSTI V USLOVIAKH GIPOKINEZII]**

S. V. KORZH, V. V. POLONSKII, L. A. MOROZOV, and V. N. NOSOV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), April 1988, p. 50, 51. In Russian.

The effect of prolonged hypokinesia due to severely limited living space, on the orthostatic cardiac reflex and on various physiological indices of the cardiovascular system was investigated together with the effect of physical exercise on the results of the test, using human subjects who remained in limited-area living quarters for up to 20 days. The test consisted in measuring ECG indices in subjects before and immediately after a sudden sit-up from a horizontal position. The results of tests were related to the capacity to do physical work, evaluated using dynamocardiography, oxyhemometry, and step test. It was found that prolonged hypokinesia leads to changes of the cardiovascular system indicating gradual lowering of the system's functional level. The orthostatic cardiac reflex continued to deteriorate during the whole period of hypokinesia, except in subjects who carried out daily physical exercises, in whom the condition stabilized on the 10th day of the hypokinetic experiment. The results of the orthostatic test could be directly correlated to work capacity. I.S.

**A88-43952\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

#### **HEALTH MAINTENANCE ON SPACE STATION**

J. S. LOGAN (NASA, Johnson Space Center, Houston, TX) IN: Space manufacturing 6 - Nonterrestrial resources, biosciences, and space engineering; Proceedings of the Eighth Princeton/AIAA/SSI Conference, Princeton, NJ, May 6-9, 1987. Washington, DC, American Institute of Aeronautics and Astronautics, 1987, p. 35-42. refs



Medical support for extended manned missions aboard such spacecraft as the NASA Space Shuttle must encompass prevention, diagnosis, and therapy capabilities in the preflight and postflight as well as actual mission phases. An evaluation is presently made of the technological and management challenges that must be met in order to furnish an adequate inflight health care delivery system that possesses adequate inflight health care, real-time environmental monitoring, physiological countermeasures, and medical rescue/recovery facilities for ill or injured crew members. O.C.

#### A88-43953#

##### RECONSIDERING ARTIFICIAL GRAVITY FOR TWENTY-FIRST CENTURY SPACE HABITATS

PETER H. DIAMANDIS (MIT, Cambridge, MA) IN: Space manufacturing 6 - Nonterrestrial resources, biosciences, and space engineering; Proceedings of the Eighth Princeton/AIAA/SSI Conference, Princeton, NJ, May 6-9, 1987. Washington, DC, American Institute of Aeronautics and Astronautics, 1987, p. 55-68. Research supported by the Space Studies Institute. refs

The medical bases for development of artificial gravity systems that can be incorporated by spacecraft on long duration missions, orbital habitats, and lunar and asteroidal bases are presented. After giving an account of the renal, cardiovascular, and musculoskeletal effects of weightlessness, attention is given to such considerations as how much artificial gravity is required, the physiological limits of radii and angular velocity for centrifugal artificial gravity systems, and the economic limits to radius and angular velocity. Motion sickness due to Coriolis cross-coupled accelerations is identified as a major problem. O.C.

#### A88-44204

##### VEGETATIVE REACTIONS DURING MNEMONIC ACTIVITY IN HUMANS WITH DIFFERENT LEVELS OF THE FUNCTIONAL SPEED OF NEURAL PROCESSES [VEGETATIVNYE REAKTSII PRI MNEMICHESKOI DEIATEL'NOSTI U LIUDEI S RAZLICHNYM UROVNEM FUNKTSIONAL'NOI PODVIZHNOSTI NERVNYKH PROTSESSOV]

N. V. MAKARENKO, V. I. VORONOVSKAIA, and L. I. LIMANSKAIA (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, May-June 1988, p. 355-363. In Russian. refs

The relationship between memory productivity and the measures of vegetative reactions accompanying mnemonic activity was investigated in human subjects with different levels of the functional speed of neural activity. The measure of this functional speed was the threshold frequency of visual stimuli at which the subject could differentiate verbal stimuli with an error not above 5 percent. It was found that humans differing in the level of the neural-activity speed also differed in the productivity of memory and in the vegetative reactions evoked by the mnemonic process. Subjects with high speed of neural activity exhibited lower background values of heart rate (HR) and higher HR during the mnemonic test, compared with subjects of below-average neural activity speed. Subjects with a low speed of neural activity exhibited lower respiration rate (RR) in the control state and high RR during mnemonic activity. I.S.

#### A88-44207

##### THE CHARACTERISTICS OF PERSPIRATION DURING WORK HYPERTHERMIA [OSOBENOSTI POTOOTDELENIIA PRI RABOCHEI GIPERTERMII]

A. S. PAVLOV (Voroshilovgradskii Mashinostroitel'nyi Institut, Voroshilovgrad, Ukrainian SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, May-June 1988, p. 434-440. In Russian. refs

The kinetics of heat accumulation and of perspiration (P) in humans were investigated in two groups of subjects (trained athletes and untrained healthy controls) after the subjects completed a continuous step-test exercise to exhaustion and after completion of an exercise scheme that included three 10-min-long periods of less rigorous muscular work separated by 3 min of rest. Perspiration was measured by electrodermal resistance. It

was found that, in trained athletes, the latent period of P was almost four times shorter, the stabilization of the P level occurred sooner, and the levels of P were 29-32 percent lower than in controls. Increases in P registered after the interrupted-work experiments were significantly higher than the increases recorded during the continuous and more strenuous step-test exercise. The dynamics of the P process in all subjects did not coincide with the dynamics of body-temperature increases. I.S.

#### A88-44208

##### THE POSSIBILITIES OF INCREASING HUMAN TOLERANCE TO ACUTE HYPOXIA AFTER ADAPTATION TO HIGH ALTITUDE AND QUICK HIGH-ALTITUDE TRAINING [VOZMOZHNOСТИ POVYSHENIIA USTOICHIVOSTI CHELOVEKA K OSTROI GIPOKSII POSLE VYSOKOGORNOI ADAPTATSII I VYSOTNOI EKSPRESS-TRENIROVKI]

A. I. KATKOV Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, May-June 1988, p. 441-445. In Russian. refs

The limits of human tolerance to acute hypoxia (measured by the degree of the stability of various cardiovascular and respiratory parameters) were tested in trained mountain climbers and in subjects who have undergone three-day-long training in a pressure chamber at altitudes equivalent to 5000-9000 m, using regimens of exercise and rest described by Katkov et al. (1982) and Kovalenko et al. (1985), respectively. The mountain climbers were divided into three groups according to the altitudes of their permanent residence and of the ascent, and to the length of adaptation to higher altitudes. It was found that the stability of the measured physiological parameters was significantly higher in mountain climbers (even 5-6 months after the last ascent) than in subjects trained in the pressure chamber. Within the altitude range of 5621-8848 m, the altitude of the ascent was not a factor. I.S.

#### A88-44209

##### THE CHARACTERISTICS OF VEGETATIVE-HORMONAL REACTIONS DURING THE PERFORMANCE OF VARIOUS TYPES OF MENTAL WORK [OSOBENOSTI VEGETATIVNO-GORMONAL'NYKH REAKTSII PRI VYPOLNENII RAZNYKH VIDOV UMSTVENNOI RABOTY]

E. V. BELOVA, V. P. EMTSEVA, and I. A. OBOLENSKII (Moskovskii Meditsinskii Stomatologicheskii Institut, Moscow, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, May-June 1988, p. 482-485. In Russian. refs

The effect of the type of mental work on cardiovascular parameters and on the concentration of ACTH, adrenaline (A), and noradrenaline (NA) in blood or urine was investigated in healthy subjects performing two types of mental test. The subjects in the first test group (the 'clock and compass', C/C test) were asked to determine the correct position of the clock hand or the compass needle from a displaced-position dial; the second test consisted in counting. It was found that subjects in the C/C test group, subjected to higher emotional stress, exhibited moderate increases in systolic pressure and decreases in blood ACTH, while the second-group subjects showed greater increases in systolic pressure and, in most cases, increases in ACTH. The excretion of A was found to increase in both test groups, but the noradrenalin (NA) excretion pattern was different. Namely, in the C/C group, the percentage of subjects with increased NA was higher than in the counting group, while the percentage of subjects exhibiting lower-than-normal NA excretion was lower. I.S.

#### A88-44210

##### INVESTIGATION OF THE EFFECT OF THE CONDITIONS OF STIMULATION ON THE THRESHOLD CHARACTERISTICS OF ELECTRODERMAL SENSITIVITY [ISLEDOVANIE VLIANIA USLOVII STIMULIATSII NA POROGOVIYE KHARAKTERISTIKI ELEKTROKOZHNOI CHUVSTVITEL'NOSTI]

I. U. M. NIKITIN and N. V. IAKOVLEVA (I Moskovskii Meditsinskii Institut, Moscow, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, May-June 1988, p. 512-515. In Russian. refs

The effects of the electrode features, such as its area in the 7-92 sq mm range, shape (round or rectangular), the configuration of its contact portion (flat, convex, or concave), and its coating

(silver, silver oxide, or stainless steel), as well as the degree of contact pressure, on the threshold of electrodermal sensitivity of the subject were investigated. It was found that the electrode area was not a factor in any of the sensitivity measurements. When the threshold was measured by the level of applied voltage, the electrode coating, the shape, the configuration of the contact, or the contact pressure had no effect. On the other hand, the threshold values measured by the current intensity and by the electric-signal power depended on the electrode coating and configuration. I.S.

**A88-44486****EFFECT OF COLD AIR INHALATION ON CORE TEMPERATURE IN EXERCISING SUBJECTS UNDER HEAT STRESS**

N. GELADAS and E. W. BANISTER (Simon Fraser University, Burnaby, Canada) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, June 1988, p. 2381-2387. refs

The effects of cold air inhalation on increases in the rectal temperatures of subjects undergoing respiratory heat loss (RHL) during exercising under heat stress are examined. Eight men cycled at 45-50 percent of their maximum work rate at an ambient temperature of 38 C and a relative humidity of 90-95 percent, while inhaling either cold (3.6 C) or ambient temperature air in random sequence. Cold air inhalation produced a nine-fold increase in RHL compared to similar work during hot air inhalation. Cold air also produced a significant decrease in heart rate in the final stages of exercise. Insignificant changes in oxygen consumption and total body fluid loss were found. It is found that cold air inhalation during exercise greatly diminishes the rate of elevation of rectal temperature, suggesting that both the intensity and duration of work can be extended if cold air is inhaled. R.B.

**A88-44489****THE LUNG AT HIGH ALTITUDE - BRONCHOALVEOLAR LAVAGE IN ACUTE MOUNTAIN SICKNESS AND PULMONARY EDEMA**

ROBERT B. SCHOENE, ERIK R. SWENSON, CHRISTOPHER J. PIZZO, PETER H. HACKETT, ROBERT C. ROACH (Washington, University; USVA, Medical Center, Seattle; Saint Anthony's Hospital, Denver, CO; Alaska, University, Anchorage) et al. *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, June 1988, p. 2605-2613. USVA-supported research. refs  
(Contract NIH-HL-00906; NIH-HL-30542; NIH-HL-33247)

The cellular and biochemical content of alveolar lavage fluid at high altitude in normal healthy subjects and in climbers with acute mountain sickness (AMS) and with high-altitude pulmonary edema (HAPE). At 4,440 m altitude, bronchoalveolar lavage was performed with 0.89 percent NaCl by fiberoptic bronchoscopy on one healthy control, three climbers with HAPE, and four with AMS. It was found that subjects with AMS had normal lavage fluid cells and proteins, while those with HAPE had high concentrations of protein and cell concentrations in the air space and high levels of cyclooxygenase, a mediator of pulmonary hypertension, and of 5-lipoxygenase, a potent chemotactic factor for leukocytes. It is concluded that agents that modify thromboxane production or the pulmonary vascular response might prevent or reverse the process that leads to HAPE. It is suggested that the gas exchange abnormality in subjects with AMS does not involve the alveolar space. R.B.

**A88-45352****SLOWING EFFECTS OF ALCOHOL ON VOLUNTARY EYE MOVEMENTS**

ZOJIRO KATO (Air Self-Defense Force, Aeromedical Laboratory, Tokyo, Japan) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, July 1988, p. 606-610. refs

The effect of a moderate dosage of alcohol on the latency and saccadic velocity of eye movements was assessed by three kinds of task complexities such as the 'simple', 'comparison', and 'addition response tasks' to displayed stimuli. Six male subjects volunteered for the study. For each subject, a total of 570 trials were made on four consecutive days. In terms of absolute alcohol,

the dose was 1.0 ml/kg of body weight. The slowing effect of alcohol on the latency ranged from 8.4 to 16.8 percent (mean 12.7 percent) corresponding to the task complexity. The impairment of the saccadic velocity ranged from 17.4 to 25.5 percent (mean 18.6 percent). It was suggested that the task complexity reflected on the latency, but not on the saccadic velocity. Author

**A88-45354****MODIFICATION OF COLOUR VISION IN THE GREEN/RED AXIS IN ACUTE AND CHRONIC HYPOXIA EXPLORED WITH A PORTABLE ANOMALOSCOPE**

JEAN-PAUL RICHLET, GUY DUVAL-ARNOULD, BERNARD DARNAUD, ANNE KEROMES, and VALENTYN RUTGERS (Association pour la Recherche en Physiologie de l'Environnement; Clinique Ophtalmologique Universitaire, Creteil, France) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, July 1988, p. 620-623. Research supported by the Ministère des Affaires Sociales et Laboratoires Sandoz. refs

The effects of acute (4350 m), subacute (4800 m), and chronic (4800 m) altitude hypoxia on color vision in the green/red axis were explored in eight sea-level natives by means of a simple portable anomaloscope. Subjects were required to create a yellow color from a mixture of red (635 nm) and green (565 nm) obtained from two electroluminescent diodes. A relative decrease in green, compared to red, sensitivity was observed in each hypoxic condition (less than 0.001). Acclimatization to altitude, evidenced by the improvement of arterial O<sub>2</sub> saturation (ear-oximeter) was accompanied by a slight but not significant return to normal color sensitivities. The influence of factors such as fatigue, season, and age is discussed and does not seem likely to account for the observed variations. Author

**A88-45355****EARLY HORMONAL EFFECTS OF HEAD-DOWN TILT (-10 DEG) IN HUMANS**

CLAUDE GHARIB, GUILLEMETTE CAUQUELIN, JEAN MARC PEQUIGNOT, GHISLAINE GELEN, CHARLES-ALBERT BIZOLLON (Lyon I, Université; CNES, Toulouse, France) et al. *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, July 1988, p. 624-629. Research supported by the Université de Lyon I and CNES. refs  
(Contract DRET-87-056)

The effects of 5-h-long weightlessness on the activities of plasma renin, aldosterone, epinephrine (E), norepinephrine (NE), and dopamine (DA) in humans were investigated using -10-deg head-down tilt (HDT) to simulate low-gravity condition. Three postural tests were conducted: 7-h sitting; 1-h sitting, 5-h horizontal bed rest (BR), and 1-h sitting; and 1-h sitting, 5-h HDT, and 1-h sitting. It was found that, compared with the sitting position, HDT and BR induced similar changes. Thus, both HDT and BR induced a significant progressive increase in plasma volume, and similar decreases in diastolic blood pressure, plasma renin (60 percent for HDT vs 40 percent for BR), aldosterone (63 percent for HDT vs 60 percent for BR), and NE (20 percent for HDT vs 25 percent for BR). DA was not changed, and E decreased in HDT only. It is concluded that the major part of the cephalad shift was achieved by bed rest as reflected by changes in hematocrit and plasma protein concentration, and that the use of a correct postural position as a control for HDT is of primary concern in studying hormonal effects of HDT. I.S.

**A88-45356****AN EVALUATION OF PRECORDIAL ULTRASONIC MONITORING TO AVOID BENDS AT ALTITUDE**

R. M. OLSON, R. W. KRUTZ, JR., G. A. DIXON, and K. W. SMEAD (Krug International, Technology Services Div., San Antonio; USAF, School of Aerospace Medicine, Brooks AFB, TX) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, July 1988, p. 635-639. USAF-sponsored research. refs

The effectiveness of precordial ultrasonic monitoring as a method to determine an approach of the altitude sickness in humans was determined in 32 subjects taken to 27,500-ft simulated altitude for 8 h or until the subject developed mild but steady

joint pain (bends); each subject was subjected to up to five 'flights', to make a total of 82 flights. The subjects were monitored by a team of experienced technicians using an ultrasonic precordial bubble detector. Clearly audible bubbles were found to occur in 77 percent of the flights in which subjects developed bends, while in 61 percent of flights in which subjects remained bends-free, no bubbles were detected. Thus, at 27,500 ft, ultrasonic monitoring missed about 25 percent of subjects affected by bends (false negatives) and yielded about 40 percent of false positives. I.S.

**A88-45358****LEFT ANTERIOR HEMIBLOCK IN OTHERWISE HEALTHY PILOTS**

MICHAEL KRIVISKY, LEAH ABERBOUCH, IGAL SHOCHAT, JOSEPH RIBAK, ARNON TAMIR (Israel Aeromedical Center, Ramat Gan) et al. *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, July 1988, p. 651, 652. refs

Several male pilots with left anterior hemiblock (LAH) were studied and compared with several age-matched controls. Exercise testing was normal in all pilots with LAH. There was no significant difference in the measurements of cardiac geometry in the 15 pilots compared to the controls, with valve thickness, mitral valve posterior motion, and septal thickness also being similar in the two groups. The pilots remained asymptomatic and on active flying duty during the mean follow-up period of 52 + or - 8 months. It is concluded that LAH is a benign condition in young asymptomatic men. Author

**A88-45359****HLA B27 POSITIVE HELICOPTER PILOT WITH REACTIVE ARTHRITIS RESPONSIVE TO SULFASALAZINE**

BRUCE K. BOHNER, JAMES J. JOCHUM, ANN M. SIEFERT, and JUDITH L. KELLY (U.S. Navy, Branch Medical Clinic, Mayport, FL) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, July 1988, p. 653, 654. refs

An aviator with prolonged right sided low back pain is described. The diagnostic workup is presented leading to diagnosis of HLA B27 positive reactive sacroiliitis. Trial of sulfasalazine leads to resolution of his pain. The spondylarthropathies are briefly reviewed. Implications on his aeromedical status are discussed. Author

**A88-45360****IGA NEPHROPATHY IN A STUDENT NAVAL AVIATOR**

V. M. VOGEL (U.S. Navy, Naval Hospital, Corpus Christi, TX) and R. SALMOND (U.S. Army, Brooke Army Medical Center, San Antonio, TX) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, July 1988, p. 655, 656. refs

Microscopic hematuria is not infrequently seen in the aviator population. After appropriate evaluation, excluding renal biopsy, such a finding is commonly diagnosed as 'benign microscopic hematuria', and no further action is taken. The clinical case presented here involves a student naval aviator whose only findings were microscopic hematuria and a unilateral high-frequency hearing loss. A renal biopsy was performed to rule out another diagnosis and IgA nephropathy was found incidentally. He was subsequently denied clearance to fly because of the uncertain outcome of the disease. Berger's disease is discussed fully as to its clinical picture, diagnosis, treatment, and prognosis. Author

**A88-45361****ALCOHOL, AVIATION, AND SAFETY REVISITED - A HISTORICAL REVIEW AND A SUGGESTION**

HARRY L. GIBBONS (Salt Lake City County Health Department, UT) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, July 1988, p. 657-660. refs

A 1964 study by Harper and Albers initiated a new era of alcohol, aviation, and safety interest. Studies by the author agreed with the Harper and Albers data. Educational efforts that followed, and the apparent effects, are described. A study commissioned by the author confirmed the effect of low levels of alcohol on flying performance. Impairment from other effects of alcohol, such as alcohol-induced hypoglycemia (AIH), postalcohol impairment (PAI), and positional alcohol nystagmus (PAN) are mentioned. It

is suggested that the effects of PAN may play a role in spatial disorientation. It is also suggested that the ingestion of alcohol days before an accident may be demonstrated by laboratory procedures. The feasibility and implementation of this should be established. If the association between previous alcohol ingestion and spatial disorientation or other impairment becomes evident, it should provide a basis for extensive education regarding aviation and safety. Author

**A88-45415****SIGNAL DETECTION THEORY AND TEMPERATURE ANALYZER CHARACTERISTICS [TEORIJA OBNARUZHENIIA SIGNALA I KHARAKTERISTIKI TEMPERATURNOGO ANALIZATORA]**

A. P. KUL'KOV, F. F. SULTANOV, and M. D. KHUDAIBERDIEV (AN TSSR, Institut Fiziologii i Eksperimental'noi Patologii Aridnoi Zony, Ashkhabad, Turkmen SSR) *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), vol. 300, no. 3, 1988, p. 752-755. In Russian. refs

The equations of the signal detection theory (SDT) introduced by Tanner and Swets (1954) were applied to study temperature-analyzer characteristics, which include both the sensory capacity of the detector and a decision-making criterion that depends on extrasensory effects. In the experiments, subjects were asked to differentiate between five thermal signals of varying temperatures, obtained from short skin contacts (3-sec contacts with 6-8-sec intervals, given in random order) with aluminum cylinders at temperatures between 33 and 48 C; each stimulus received 300 estimates. The histograms obtained on the basis of these estimates were used to calculate the relationships between the probability of correct and false detections and between correct detections and temperature and, using the SDT equations, to estimate quantitative changes in the sensory capacity and in the decision-making criterion that were brought about by changes in the signal temperature. I.S.

**N88-24158** New South Wales Univ., Sydney (Australia). School of Medicine.

**ACTIVATION, STRENGTH AND ENDURANCE OF HUMAN RESPIRATORY AND LIMB MUSCLES Ph.D. Thesis Abstract Only**

D. K. MCKENZIE 1987 270 p

Avail: Issuing Activity

The aspects of muscle function is reviewed with emphasis on factors which may limit force generation during the types of muscular effort studied in the experimental chapters. The use of a test which enables direct comparison of endurance properties in human respiratory and limb muscles is reported. The use of phrenic nerve stimulation to investigate the function of the phrenic nerve and diaphragm, and to document the potential sources of error in recordings of the electromyographic activity (EMG) of the diaphragm is described. Phrenic nerve stimulation and recordings of EMG are used to study voluntary activation of the phrenic motoneurone pool during maximal voluntary contractions of the diaphragm and during diaphragmatic fatigue. The influence of changes in muscle length on endurance is examined. The capacity of respiratory muscles to adapt to physiological loading is suggested in a study of asthmatic and control subjects. The relative proportions and sizes of fiber types in three human inspiratory muscles and a control limb muscle are reported. Some of the implications of this study are examined. Author

**N88-24159** New South Wales Univ., Sydney (Australia).

**DESIGN CONSIDERATIONS FOR THE DEVELOPMENT OF AN IMPLANTABLE SENSOR FOR THE CONTINUOUS MEASUREMENT OF GLUCOSE IN THE DIABETIC PATIENT M.S. Thesis Abstract Only**

MICHAEL DAVID HALLETT 28 Sep. 1987 169 p

Avail: Issuing Activity

The basic design of the sensor incorporates a small column of immobilized glucose oxidase (GOD) through which a buffered carrier stream is passed. The device is designed for peritoneal implantation. Initial work tested the feasibility of such a design for



the quantitative analysis of glucose using spectrophotometric analysis of the produced hydrogen peroxide. Subsequently, efforts were concentrated on the development of a model device involving the design and construction of perspex hardware and associated drift free electronic circuitry for use with oxygen sensors. In addition, methods for improvement in long term enzymatic stability were formulated and tested in a series of batch stabilization studies using two types of carbohydrate gel. A number of additives were also tested, including flavin adenine dinucleotide (FAD) and FeCl<sub>3</sub>. However, results indicated that enzyme immobilization and GA crosslinking were the most significant factors in reducing enzyme inactivation with the addition of FAD and FeCl<sub>3</sub> showing little or no effect. Bacteriological contamination was highly significant in enzyme activity decay as was high pH. Author

**N88-24160** New South Wales Univ., Sydney (Australia). Centre for Biomedical Engineering.

**MATHEMATICAL MODELLING OF THE HEAT AND WATER VAPOUR TRANSPORT IN THE HUMAN RESPIRATORY TRACT**  
**M.S. Thesis Abstract Only**

EVANGELIA DAVISKAS 1987 182 p

Avail: Issuing Activity

To study the heat and water vapor transport in the human respiratory tract (putatively associated with asthma) while conditioning the inspired air, it is necessary to obtain estimates of intraairway temperatures and water contents. Because these cannot be routinely obtained by direct measurements, a time-dependent mathematical model was developed that could predict them. The wall temperatures were modelled iteratively to give estimates of temperature gradients. The predicted intraairway temperatures at five locations for inspired temperature 26.7 °C, inspired water 8.8 mg/L and ventilation 15 to 100 L/min, reproduced experimental data. The model predicted air temperature and water vapor concentrations at mouth, total heat and water loss per breath that were in good agreement with experimental data if water vapor concentration at the wall was unsaturated from mouth to larynx. The model predicted that conditioning of inspired room air involves not only the extrathoracic airways but the intrathoracic airways, the number of airways being involved depending on the ventilation. The airstream temperature and water vapor concentration equilibrate with the wall temperature and water vapor concentration before the core temperature is reached. It was also predicted that the overall heat and water loss along the respiratory tract during a respiratory cycle is not continuous as some airways gain heat and water. Author

**N88-24161\*** National Aeronautics and Space Administration, Washington, D.C.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 311)**

Jun. 1988 82 p

(NASA-SP-7011(311); NAS 1.21:7011(311)) Avail: NTIS HC A05 CSDL 06E

This bibliography lists 240 reports, articles, and other documents introduced into the NASA scientific and technical information system in May, 1988. Author

**N88-25135#** Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

**A SYSTEMS ENGINEERING BASED METHODOLOGY FOR ANALYZING HUMAN ELECTROCORTICAL RESPONSES**  
**Summary Report, Sep. 1983 - Dec. 1986**

ANDREW M. JUNKER, WILLIAM H. LEVISON, and RICHARD T. GILL 20 Jul. 1987 199 p

(AD-A190809; AAMRL-TR-87-030) Avail: NTIS HC A09/MF A01 CSDL 06D

The objective of this work was to develop a systems engineering based methodology for quantifying and modeling effects of cognitive loading on human electrocortical responses in systems engineering terms. The visual-cortical response was selected as the input-output channel around which the methodology was developed. A steady-state input (a continuous sum of 10 sine waves) and a transient input (a train of pulses) were used

for system stimulation. The human occipital EEG (surface electrodes at Oz and mastoids) was used as the cortical describing functions (gain and phase) and remnant spectra (background EEG). A stimulus parametric investigation indicated that sensitivity to stimulus modulation depth is unequal across frequencies, and that relatively low stimulus intensity and depth of modulation are desirable to reduce response saturation. Comparisons between transient and steady-state simulation revealed that both forms produced functionally related responses, suggesting that the visual-cortical response contains a measurable linear portion. Time domain amplitude changes corresponded to transient and steady-state gain changes. To investigate cognitive loading effects three tasks were utilized: manual tracking, grammatical reasoning, and supervisory control. Changes in visual-cortical response measures related to task loading were observed. With increased cognitive loading, alpha responders generally showed reductions in alpha band gain and remnant. GRA

**N88-25136#** Rockefeller Univ., New York.

**MOTOR THEORY OF AUDITORY PERCEPTION Annual Technical Report, 1 Sep. 1986 - 31 Aug. 1987**

HEATHER WILLIAMS 24 Sep. 1987 39 p

(Contract AF AFOSR-0336-86)

(AD-A192095; AFOSR-87-1563TR) Avail: NTIS HC A03/MF A01 CSDL 06C

The behavioral and neural substrate for motor processing of vocalizations exists in an animal model (the zebra finch). What had been considered a simple vocalization, learned from one model and carrying one message, proves to consist of compound sound units (syllables) arranged in a complex structure. The syllables in each vocalization are learned from several different sources or improvised, and are assembled to form a new vocalization. The vocal motor neurons have an auditory function (the muscles of the vocal organ contract slightly when the animal is presented with an auditory stimulus), the vocal motor neurons are spatially ordered according to their target muscle (and hence their vocal function), and vocal motor neurons in different pools have different auditory responses. Behavioral experiments to test whether the vocal motor system is involved in perception have been initiated. A new method for visual analysis of sounds is being tested. GRA

**N88-25137** National Building Research Inst., Pretoria (South Africa).

**EFFECTS OF MODERATE COLD AND HEAT STRESS ON THE POTENTIAL WORK PERFORMANCE OF INDUSTRIAL WORKERS. PART 6: THE EFFECTS OF INCREASING VAPOUR PRESSURE AT FOUR AIR TEMPERATURES ON THE PERFORMANCE AND PHYSIOLOGY OF WHITE FEMALES**

R. KOK, G. B. MEESE, and M. I. LEWIS 1986 30 p

(PB88-124854; CSIR-RR-630-PT-6; ISBN-0-7988-3289-4) Avail: NTIS HC E05/MF E05 CSDL 06S

Part six in the continuing series detailing the effects of moderate cold and heat stress on the potential work performance of industrial workers. The effects of increasing humidity at four air temperatures on the performance and physiology of white female workers are examined. Dissert. Abstr.

**N88-25138** New South Wales Univ., Kensington (Australia). School of Biochemistry.

**A CARDIOSTIMULANT PROTEIN FROM THE AUSTRALIAN RED WARATAH SEA ANEMONE, ACTINIA TENEBROSA**  
**Abstract Only. M.S. Thesis**

MURRAY THOMSON Jan. 1987 78 p

Avail: Issuing Activity

Toxic polypeptides from coelenterates can be differentiated on the basis of size into three groups, one of 2,000 to 3,000, a second with 4,000 to 6,000 and a third having molecular weights over 10,000. The first two groups of sea anemone toxins act on excitable membranes and affect mainly the fast sodium channel. At high doses members of the first group are cardio- and neurotoxins but at low doses they are useful cardiostimulants. Members of the third group are sometimes cardioactive and

generally cytolytic. A cardiostimulant protein was purified to electrophoretic homogeneity from the Australian Red Waratah sea anemone *Actinia tenebrosa* by subjecting sulphate precipitates of *A. tenebrosa* extracts to gel filtration, ion exchange, and adsorption chromatography. The resulting protein Tenebrosin-I, was found to be hemolytic and have a molecular weight of 20,000. It can be classified as a group 3 sea anemone toxin. Preliminary pharmacological characterization of tenebrosin-I suggests that the molecule may exert its biological effects by forming channels in cell membranes. Additional characterization of the proteins mode of action forms the basis of this study. Author

**N88-25139#** Army Research Inst. of Environmental Medicine, Natick, Mass.

**PHYSIOLOGICAL AND HEMATOLOGICAL RESPONSES OF MATCHED OLDER AND YOUNGER MEN DURING DRY-HEAT ACCLIMATION**

KENT B. PANDOLF, BRUCE S. CADARETTE, MICHAEL N. SAWKA, ANDREW J. YOUNG, and RALPH P. FRANCESCONI  
Jun. 1987 27 p  
(AD-A186450) Avail: NTIS HC A03/MF A01 CSCL 06P

Nine younger and nine older men were matched for body weight, surface area, surface area-to-weight ratio, percent body fat, and maximal aerobic power, but differed in age by 25 years and regular weekly aerobic activity. After evaluation in a comfortable environment (22 C, 50 percent rh), these subjects were concurrently heat acclimated by treadmill walking for two to 50 min exercise bouts separated by, 10 min rest for 10 consecutive days in a hot-dry environment. During the first day of exposure, performance time was 27 min longer for the older men while final rectal and skin temperatures and heart rate were lower, and final total body sweat loss higher when compared to younger men. These physiological advantages for the older men persisted for the first few days of exercise-heat acclimation. By the end of acclimation, no physiological or performance time differences were observed between groups. Final rated perceived exertion was generally higher for the younger men throughout the acclimation period while final thermal sensation was higher only on the first acclimation day. Sweating sensitivity, esophageal temperature at sweating onset, and the sweating onset time did not differ between groups either pre- or post-acclimation. GRA

**N88-25140\*#** National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

**CARDIOVASCULAR EFFECTS OF WEIGHTLESSNESS AND GROUND-BASED SIMULATION**

HAROLD SANDLER Jun. 1988 103 p  
(NASA-TM-88314; A-86284; NAS 1.15:88314) Avail: NTIS HC A06/MF A01 CSCL 06P

A large number of animal and human flight and ground-based studies were conducted to uncover the cardiovascular effects of weightlessness. Findings indicate changes in cardiovascular function during simulations and with spaceflight that lead to compromised function on reambulation and/or return to earth. This altered state termed cardiovascular deconditioning is most clearly manifest when in an erect body state. Hemodynamic parameters indicate the presence of excessive tachycardia, hypotension (leading to presyncope in one-third of the subjects), decreased heart volume, decreased plasma and circulating blood volumes and loss of skeletal muscle mass, particularly in the lower limbs. No clinically harmful effects were observed to date, but in-depth follow-ups were limited, as was available physiologic information. Available data concerning the causes for the observed changes indicate significant roles for mechanisms involved with body fluid-volume regulation, altered cardiac function, and the neurohumoral control of the control of the peripheral circulation. Satisfactory measures are not found. Return to preflight state was variable and only slightly dependent on flight duration. Future progress awaits availability of flight durations longer than several weeks. Author

**N88-25141\*** NASA Scientific and Technical Information Facility, Baltimore/Washington International Airport, Md. 21240.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 312)**

Jul. 1988 99 p  
(NASA-SP-7011(312); NAS 1.21:7011(312)) Avail: NTIS HC A06; NTIS standing order as PB88-912300, \$9.00 domestic, \$18.00 foreign CSCL 06E

This bibliography lists 300 reports, articles, and other documents introduced into the NASA scientific and technical information system in June, 1988. Author

## 53

## BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**A88-41556**

**SPATIAL REQUIREMENTS FOR VISUAL SIMULATION OF AIRCRAFT AT REAL-WORLD DISTANCES**

ROBERT S. KENNEDY, KEVIN S. BERBAUM (Iowa, University, Iowa City), STANLEY C. COLLYER (U.S. Navy, Office of Naval Technology, Arlington, VA), JAMES G. MAY (New Orleans, University, LA), and WILLIAM P. DUNLAP (Tulane University, New Orleans, LA) Human Factors (ISSN 0018-7208), vol. 30, April 1988, p. 153-161. refs

To provide target image sufficiency guidelines for ground-based flight training simulators, a detection experiment examined the relative effects of contrast, resolution, and brightness on the simulated distance at which subjects could determine the orientation of another aircraft. With high resolution, a luminance contrast of 25:1 produced better performance than lower contrasts. The performance at the best contrast condition was 40 percent better than at the poorest, whereas the best resolution condition produced only 20 percent better performance than the poorest. In three identical contrast conditions, higher luminance levels results in slightly better performance. In the best experimental condition, average aspect recognition thresholds for the TA-4J aircraft occurred at simulated distances of greater than 4 miles (6.44 km), whereas in the most degraded condition, average thresholds occurred at simulated distances of 1.5 miles (2.415 km). Author

**A88-41557**

**OPERATOR PERFORMANCE AS A FUNCTION OF TYPE OF DISPLAY - CONVENTIONAL VERSUS PERSPECTIVE**

SUZANNE V. BEMIS, JEFFREY L. LEEDS, and ERNST A. WINER (U.S. Navy, Naval Ocean Systems Center, San Diego, CA) Human Factors (ISSN 0018-7208), vol. 30, April 1988, p. 163-169.

The purpose of this experiment was to evaluate operator performance on a perspective tactical display. The distinguishing feature of the perspective display is its visual representation of vertical as well as horizontal craft information. In contrast, current tactical display systems provide only two-dimensional views requiring numerical representation for altitude information. Subjects were required to perform two tasks: detect threats and select the closest interceptor for each detected threat. Errors and response time were recorded for each subject by the computer in a completely within-subjects experimental design. The experiment revealed a significant reduction in errors of detection and interception with the use of a perspective display. Response time for selecting interceptors was greatly reduced. The discussion recommends relevant directions for future research. Author

**A88-41559**

**EFFECTS OF VISUAL DISPLAY AND MOTION SYSTEM DELAYS ON OPERATOR PERFORMANCE AND UNEASINESS IN A DRIVING SIMULATOR**

LAWRENCE H. FRANK, JOHN G. CASALI, and WALTER W.

WIERWILLE (Virginia Polytechnic Institute and State University, Blacksburg) Human Factors (ISSN 0018-7208), vol. 30, April 1988, p. 201-217. Navy-supported research. refs

The role of visual-motion coupling delays and cuing order on operator performance and uneasiness was assessed in a driving simulator by means of a response surface methodology central-composite design. The most salient finding of the study was that visual delay appears to be more disruptive to an individual's control performance and well-being than motion delay. Empirical multiple regression models were derived to predict 10 reliable measures of simulator operator driving performance and comfort. Principal components analysis on these 10 models decomposed the dependent measures into two significant models, which were labeled vestibular disruption and degraded performance. Examination of the empirical models revealed that for asynchronous delay conditions, better performance and well-being were achieved when the visual system led the motion system. A secondary analysis of the role of subject gender and perceptual style on susceptibility to simulator sickness revealed that neither of these independent variables was a significant source of variance. Author

#### A88-42624

##### LOCALIZATION OF COGNITIVE OPERATIONS IN THE HUMAN BRAIN

MICHAEL I. POSNER, STEVEN E. PETERSEN, PETER T. FOX, and MARCUS E. RAICHLE (Washington University, Medical Center, Saint Louis, MO) Science (ISSN 0036-8075), vol. 240, June 17, 1988, p. 1627-1631. Research supported by Washington University. refs  
(Contract N00014-86-K-0289; NIH-NS-06833; NIH-HL-13851; NIH-NS-14834; NIH-AG-03991)

The human brain localizes mental operations of the kind posited by cognitive theories. These local computations are integrated in the performance of cognitive tasks such as reading. To support this general hypothesis, new data from neural imaging studies of work reading are related to results of studies on normal subjects and patients with lesions. Further support comes from studies in mental imagery, timing, and memory. Author

#### A88-42913

##### VERTICAL FLIGHT TRAINING NEEDS AND SOLUTIONS; PROCEEDINGS OF THE AHS NATIONAL SPECIALISTS' MEETING, ARLINGTON, TX, SEPT. 17, 18, 1987

Meeting sponsored by AHS, FAA, and Helicopter Association International. Alexandria, VA, American Helicopter Society, Inc., 1987, 139 p. For individual items see A88-42914 to A88-42926.

Papers concerning vertical flight training are presented, covering topics such as mishap reduction, accident trends, situational awareness, and the role of the FAA in helicopter safety. Safety concerns for Emergency Medical Service, TV news, and commercial airline helicopters, the application of military training for commercial operations, and the role of management and pilots in promoting professionalism are examined. Studies dealing with helicopter insurance rates, the impact of product support on aviation safety, and training technical personnel for quality maintenance are included. R.B.

#### A88-42916#

##### SITUATIONAL AWARENESS

R. WILLIAM DE DECKER (FlightSafety International, Inc., Communication Systems Div., Hurst, TX) IN: Vertical flight training needs and solutions; Proceedings of the AHS National Specialists' Meeting, Arlington, TX, Sept. 17, 18, 1987. Alexandria, VA, American Helicopter Society, Inc., 1987, p. 27-31.

The importance of cockpit management skills in establishing and maintaining situational awareness is discussed. The effects of physical flying skills, experience and training, spatial orientation, and health and attitude are examined. Aspects of cockpit management which contribute to situational awareness considered include cockpit distractions, stress management, the use and function of checklists, communication skills, workload assessment

and time management, decision making and judgment, management of flight resources and personnel, flight planning and progress monitoring, and pattern recognition. R.B.

#### A88-42918#

##### AN AIRLINE PERSPECTIVE FOR HELICOPTERS

J. A. BROWN (American Airlines, Inc., Fort Worth, TX) IN: Vertical flight training needs and solutions; Proceedings of the AHS National Specialists' Meeting, Arlington, TX, Sept. 17, 18, 1987. Alexandria, VA, American Helicopter Society, Inc., 1987, p. 41-45.

The use of a standardized training program for commercial helicopter pilots is proposed. The proposed plan would centralize training to standardize and control its quality, modernize training techniques, and make more extensive use of flight simulators. It is suggested that commercial manufacturers and operators should collectively establish a mutually supported training program patterned after ground school and flight simulator training used by commercial airlines which would be affordable to all operators and would provide training for helicopter ground support personnel. It is felt that the cost of such a program would be offset by the resulting reduction in human factor accidents and product liability costs. R.B.

#### A88-42919#

##### NOW MORE THAN EVER - 'VERTICAL FLIGHT TRAINING'

ROY L. MORGAN (Air Methods Corporation International, Englewood, CO) IN: Vertical flight training needs and solutions; Proceedings of the AHS National Specialists' Meeting, Arlington, TX, Sept. 17, 18, 1987. Alexandria, VA, American Helicopter Society, Inc., 1987, p. 49-53. refs

An overview of vertical flight training is presented, suggesting the need for improvements in training so that more helicopter pilots can fly under Instrument Flight Rules (IFR). It is felt that the FAA should require commercial helicopter pilots to meet the same instrument skill level required for commercial airplane pilots and that operators should be required to provide IFR certified helicopters and IFR qualified pilots for night operations. The need for new training facilities, aircraft, and instructors to make training economically more feasible is stressed. R.B.

#### A88-42920#

##### MILITARY TRAINING - COULD IT WORK FOR COMMERCIAL OPERATIONS?

JACK A. MITTEER (McDonnell Douglas Helicopter Co., Culver City, CA) IN: Vertical flight training needs and solutions; Proceedings of the AHS National Specialists' Meeting, Arlington, TX, Sept. 17, 18, 1987. Alexandria, VA, American Helicopter Society, Inc., 1987, p. 65-69. refs

The possible use of military rotorcraft training programs for commercial helicopter operations is discussed. Teaching and evaluation methods of the Army Aircrew Training Program such as the annual proficiency and readiness test, the aircrew training manual and the refresher flight training guide are examined, stressing the program's use in accident reduction. Differences between military and commercial training are discussed, suggesting that a simplified version of the Army program could be applied for basic commercial use. R.B.

#### A88-42922#

##### TEACHING THE 'RIGHT STUFF' IN AVIATION TRAINING

PETER L. GINOCCHIO (Canadair Challenger, Inc., Westport, CT) IN: Vertical flight training needs and solutions; Proceedings of the AHS National Specialists' Meeting, Arlington, TX, Sept. 17, 18, 1987. Alexandria, VA, American Helicopter Society, Inc., 1987, p. 85-88.

The need for pilot training to include learning the idiosyncrasies of specific models of aircraft is stressed. The largest number of accidents involving a specific model occur when the model is first introduced because of a lack of maintenance experience and flight training for the model. For this reason, and because most training programs focus on the minimum requirements for certification, more specialized training is suggested. The use of incident reports, delay

and cancellation reports, service occurrence reports, warranty claims, and operator comments in developing a training program is examined. R.B.

**A88-42926#****EXPERIENCE THROUGH TRAINING - THE KEY TO TILTROTOR SAFETY**

MICHAEL R. FARREN and ROBERT RYAN WILKINS (Boeing Helicopter Co., Wichita, KS) IN: Vertical flight training needs and solutions; Proceedings of the AHS National Specialists' Meeting, Arlington, TX, Sept. 17, 18, 1987. Alexandria, VA, American Helicopter Society, Inc., 1987, p. 125, 127-137. refs

The use of training to provide experience to flying and maintenance crews for tiltrotor craft is discussed. The need to make fixed wing pilots understand the priority of vertical axis awareness and the use of judgment and decision making training are examined. It is found that equal training in helicopter and airplane skills was best for performing 65 percent of the tasks used in tiltrotor flying, with helicopter training better for 28 percent of tasks. The ways in which a flight training program is analyzed, designed, developed, implemented, and evaluated are presented, and the use of simulator training for maintenance crews is discussed. R.B.

**A88-42927****INTERNATIONAL SYMPOSIUM ON AVIATION PSYCHOLOGY, 4TH, COLUMBUS, OH, APR. 27-30, 1987, PROCEEDINGS**

RICHARD S. JENSEN, ED. (Ohio State University, Columbus) Symposium sponsored by the Ohio State University and Association of Aviation Psychologists. Columbus, OH, Ohio State University, 1987, 808 p. For individual items see A88-42928 to A88-43007.

Topics discussed include engineering in the areas of cockpit design, voice technology, expert systems, simulation, and ATC automation; the psychology of perception, judgment, cockpit resource management, and communication in aviation; selection and training; the physiological effects of stress, fatigue, and drugs and alcohol; workload assessment; performance assessment; and accident investigation. Papers are presented on a tactical aircraft cockpit study, the application of voice technology in space vehicles, expert systems for risk assessment, and the use of the ILLIMAC simulator in research at the University of Illinois. Attention is also given to the judgment of speed with computer-generated motion displays, training for imminent emergencies, the formation process of airline flight crews, the relative impact of selection and training on optimal crew performance, and instruction for military air intercept control. Additional papers are on attention in aviation, the spontaneous eye blink in workload assessment, the inadequacy of root mean square error as a performance measure, and the root causes of helicopter pilot error accidents. I.S.

**A88-42933\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**SPACE VEHICLE APPROACH VELOCITY JUDGMENTS UNDER SIMULATED VISUAL SPACE CONDITIONS**

RICHARD F. HAINES (NASA, Ames Research Center, Moffett Field, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 44-50. Previously announced in STAR as N88-19094. refs

Thirty-five volunteers responded when they first perceived an increase in apparent size of a collimated, 2-D image of an Orbiter vehicle. The test variables of interest included the presence of a fixed angular reticle within the field of view (FOV); three initial Orbiter distances; three constant Orbiter approach velocities corresponding to 1.6, 0.8, and 0.4 percent of the initial distance per second; and two background starfield velocities. It was found that: (1) at each initial range, increasing approach velocity led to a larger distance between the eye and Orbiter image at threshold; (2) including the fixed reticle in the FOV produced a smaller distance between the eye and Orbiter image at threshold; and (3) increasing background star velocity during this judgment led to a smaller distance between the eye and Orbiter image at threshold. The last two findings suggest that other detail within the FOV may

compete for available attention which otherwise would be available for judging image expansion; thus, the target has to approach the observer nearer than otherwise if these details were present. These findings are discussed in relation to previous research and possible underlying mechanisms. Author

**A88-42938#****ACOUSTIC-PHONETIC CHANGES IN SPEECH DUE TO ENVIRONMENTAL STRESSORS - IMPLICATIONS FOR SPEECH RECOGNITION IN THE COCKPIT**

THOMAS J. MOORE (USAF, Harry G. Armstrong Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) and Z. S. BOND (Ohio University, Athens) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 77-83. refs

The effects of various environmental stressors, such as noise, oxygen mask, acceleration, and vibration, on speech production were investigated. Recordings of speech of male speakers, who wore standard Air Force flight helmets with oxygen masks and were breathing air supplied through a chest-mounted regulator, were made during centrifuge rides. It was found that, compared to control conditions, fundamental frequency increased under all experimental conditions for all talkers, with each of the stressors resulting in the increased vocal effort of the talker (reflected in an increase in fundamental frequency). Relative amplitude increased for speech produced in the presence of noise when a boom microphone was used, but showed no systematic change when the talker wore an oxygen mask, as was the case for speech produced under acceleration and vibration when the talkers wore oxygen masks. In general, the vowel space became more compact for speech produced in presence of any of the stressors. I.S.

**A88-42945#****MULTIATTRIBUTE EVALUATION OF SIMULATOR FLIGHT PERFORMANCE IN RESEARCH AND TRAINING**

JAMES C. MUNDT and LEONARD E. ROSS (Wisconsin, University, Madison) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 151-157. refs (Contract PHS-AA-06093)

A multiattribute pilot-performance evaluation model was developed using the results of a simulator flight study designed to develop useful indices of pilot performance. With the aid of experienced flight instructors, 15 single-dimensional flight parameters were weighted and combined into three performance aspects identified (the horizontal control and the vertical control of the aircraft, and the cockpit duties required of the pilot). This approach provided a general measure of pilot's performance for each task, and a means of combining the task performance values in order to provide an overall measure of pilot performance. The flight task was carried out in a modified ATC procedure trainer described by Ross and Mundt (1986), with 12 pilots required to complete a 45-min flight on each of two consecutive days. I.S.

**A88-42947#****SOURCES OF STRESS AFFECTING PILOT JUDGMENT**

EDWARD C. SIMMEL, MICHAEL CERKOVNIK, and JAMES E. MCCARTHY (Miami University, Oxford, OH) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 190-194. refs

The possible effect of life stress on the subject's ability to assess of the consequences of nonroutine events was investigated together with measures of life stress. A questionnaire (termed the Life Events Questionnaire, LEQ) was developed, designed to provide several categories of information regarding the presence and the extent of life stress events (both positive and negative) that can happen to an individual, and thus to provide measures of life stress. The LEQ was administered to 220 introductory psychology students participating in an ATC study. Errors in the assessment of potential consequences were made by 91 percent of the subjects, of which 69 percent were consistent overassessors

or underassessors, suggesting that the tendency to over- or underassess is consistent within an individual in a given situation. High-life-stress and low-stress individuals performing an ATC task did not differ in competency, the accuracy of assessment, or on over- vs underassessment. There were no sex differences. I.S.

#### A88-42949#

##### ACTIVE CONTROL OF ACCELERATING AND DECELERATING SELF MOTION

BRIAN S. ZAFF and DEAN H. OWEN (Ohio State University, Columbus) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 209-215. refs

An interactive methodology is described for investigating the perception-action cycle during active control of accelerating and decelerating self motion making it possible to determine whether optical variables that affect the participant's ability to detect changes in the speed of self motion will also affect their ability to control those changes. In these experiments, the individual being tested to perform a particular task, such as maintaining a constant direction and speed of travel, are receiving visual feedback by perceiving the consequences of their actions. The simulated self-motion events were generated by a special-purpose digital image generator that produced real-time perspective transformations displayed on a video projection unit, and a Measurement Systems Model 436 force-sensing control was used to control the change in speed of simulated flight by pulling back on the control stick to counter acceleration or pushing forward to counter deceleration. The results showed that, as the change in the rate of self motion became easier to detect, the action intended to cancel the change became more accurate. I.S.

A88-42950\*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

##### THE VISUAL CONTROL OF SIMULATED ALTITUDE

WALTER W. JOHNSON (NASA, Ames Research Center, Moffett Field, CA), C. THOMAS BENNETT (NASA; U.S. Army, Washington, DC), PAMELA S. TSANG (Illinois, University, Urbana), and ANIL V. PHATAK (Analytical Mechanics Associates, Inc., Mountain View, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 216-222.

The ability of a subject flying an experimental flight to use the different sources of visual information by looking at the vertical tracking error was investigated using a 3 (altitude) x 3 (texture) x 2 (replication) factorial design. Each subject flew these 18 flights in the same partially counterbalanced order, constructed such that there was one flight at each of the three altitudes, and over each of the three surface textures within each successive set of three flights. The three ground-surface textures used consisted of meridian, latitudinal, and square textures described by Wolpert et al. (1983). The results showed that, in displays where only splay information was available, the subjects tended to confuse lateral motion with vertical. I.S.

#### A88-42951#

##### FIELD OF VIEW VERSUS RETINAL FIELD IN THE DETECTION OF LOSS IN ALTITUDE

L. WOLPERT (Ohio State University, Columbus) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 223-230. refs

The relative roles of the central and the peripheral vision in the detection of loss in altitude were investigated. To study the independent effects of the two vision factors, the region of retinal stimulation (i.e., central versus peripheral) was factorially crossed with the field of view (i.e., front versus side). The detection of loss in altitude was examined over three types of texture (square and parallel or perpendicular to the direction of flight). The results demonstrated the usefulness of change in optical splay as a source of information for detecting loss in altitude. In the front view, splay information was provided by parallel and square textures, while in the side view it was provided by perpendicular and square textures.

The central region of retinal stimulation was found to be more sensitive to self motion than peripheral regions of the retina, and this sensitivity was independent of the field of view. I.S.

#### A88-42952#

##### MASKING OF MOTION CUES BY RANDOM BACKGROUND MOTION

GLENN L. GREIG and LLOYD D. REID (Toronto, University, Downsview, Canada) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 237-243. NSERC-supported research. refs

A study of the ability of human subjects to detect a sinusoidal whole-body motion signal superimposed on a background of random whole-body motion on the same axis was conducted in a six-degree-of-freedom moving-base flight simulator. A total of 28 cases were considered, using two axes of motion (pitch and surge) at frequencies of 0.2 and 0.6 Hz, with seven different background motion conditions. In each of 50 trials, the subject was asked to determine which of two intervals contained a sinusoidal motion signal in addition to the random motion. It is concluded that signal detectability is a function of signal-to-noise ratio. Results from narrow band spectra show that sinusoidal motion is masked primarily by noise components near the signal frequency. R.B.

#### A88-42953#

##### JUDGMENT OF SPEED WITH COMPUTER GENERATED MOTION DISPLAYS

JOHN F. LARISH and JOHN M. FLACH (Illinois, University, Urbana) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 244-250. USAF-supported research.

The relative contribution of two variables, the optical edge rate and the global optical flow rate to the perception of egospeed, or the speed of self-motion is examined. The optical edge rate is the speed at which texture elements pass a given point in the subject's field of view, while the global optical flow rate is the rate of expansion of the visual field, a ratio of forward velocity and altitude. The variables are manipulated in a simulation of low altitude rectilinear flight using two types of display, grid display and a randomly distributed dot display and monocular and binocular viewing conditions. In uncontrolled conditions, the optical edge rate was found to be the dominant source of information used, with the global optical flow rate having no significant effect. In controlled viewing conditions, the global optical flow rate had a much greater effect. The results suggest that the cues used in the judgment of egospeed change as a function of the availability of conflicting two-dimensional depth cues. R.B.

#### A88-42954#

##### A SIMULATOR-BASED APPROACH TO TRAINING IN AERONAUTICAL DECISION MAKING

THOMAS J. CONNOLLY, BISHOP B. BLACKWELL (Embry-Riddle Aeronautical University, Daytona Beach, FL), and LEWIS F. LESTER (Colby College, Waterville, ME) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 251-257. refs

A study comparing the performance of 16 pilots who received classroom instruction and simulator training in aeronautical decision making with 13 subjects trained under a control condition which focused on basic instrument flying is presented. Performance of subjects was evaluated using self-assessment and flight simulation administered before and after the training. Subjects who received four hours of classroom instruction in risk assessment and decision making followed by four instructional simulations in which they experienced several critical in-flight events performed significantly better than control group subjects when evaluated later on their handling of such events. It is suggested that effective judgment training can be accomplished without reliance upon actual aircraft flight time and that the training program can be used with pilots who are beyond the initial stages of their training. R.B.

**A88-42955#****MENTAL MODELS, UNCERTAINTY, AND IN-FLIGHT THREAT RESPONSES BY AIR FORCE PILOTS**

MARVIN S. COHEN (Decision Science Consortium, Inc., Falls Church, VA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 258-264. (Contract F33615-86-C-1097)

Personalized and prescriptive decision support, a computerized decision aid based on cognitive theory, has been applied to the design of interactive displays for in-flight avionics systems. A preliminary prototype display system was developed, based on structured pilot interviews and evaluated by pilots. The display system was then revised. Pilot evaluations of the final prototype are given. It is concluded that a mix of cognitive science theory and empirical testing can lead to progress in the development of cognitively compatible displays. R.B.

**A88-42956#****PILOT JUDGEMENT TRAINING - THE AUSTRALIAN STUDY**

ROSS TELFER (Newcastle, University, Australia) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 265-273. refs

An Australian study of the effectiveness of pilot judgment training which tested student pilots before and after instruction is presented. The subjects were divided into three groups: an academic group which was issued a manual only, an experimental group which received a manual and special instruction, and a control group. Written exams and flight tests were used for evaluating pilot performance. It is found that the performance of the experimental group was much higher, providing statistical substantiation of North American pilot judgment training studies. It is concluded that the process of training is more important than the content of training materials. R.B.

**A88-42957#****TRAINING FOR IMMINENT EMERGENCIES**

FRANK MONASTERO, SR. (T. M. Monitor Corp., McLean, VA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 274-277.

Two aspects of private pilot training for emergencies are discussed: whether or not pilots are psychologically prepared to meet a true emergency if, as student pilots, they themselves established the environment within which the emergency procedures were practiced and if pilots might be psychologically conditioned to believe that a crash is unavoidable during certain emergencies if, during practice emergencies, failure to attain one test standard meant failure to pass the test for that procedure. Two emergency situations are presented and analyzed. Although simulator training could be used to address emergency situations, it is rarely available. It is concluded that instructors should establish the condition which simulates the emergency, that practice of a single corrective action should not be consecutive, and that greater emphasis should be placed on analysis of the cause of the emergency. R.B.

**A88-42958#****THE MEASUREMENT OF HAZARDOUS THOUGHT PATTERNS AND THE RELATIONSHIP TO PILOT PERSONALITY**

LEWIS F. LESTER (Colby College, Waterville, ME) and THOMAS J. CONNOLLY (Embry-Riddle Aeronautical University, Daytona Beach, FL) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 286-292. refs

A study to establish base rates for different hazardous thought patterns (HTPs) and to determine how HTPs are related to pilot personality and whether HTPs and pilot personality are related to pilot involvement in dangerous aviation events is discussed. The relationship among five HTPs and the utility of two modified forms of the Pilot Decision-Making Questionnaire (PDMQ) in assessing HTPs are examined. Invulnerability is found to be the predominant

HTP, and it is probable that irrational decision-making can be accounted for by reference to the invulnerable, macho and impulsive patterns alone. Pilots with poorer judgment are shown to have a more external locus of control and lower levels of integration. It is concluded that both forms of the PDMQ are useful, and that HTPs and the global measure of irrational pilot judgment are related to pilot personality and to the risk of involvement in dangerous aviation events. R.B.

**A88-42959#****A PROGRAM TO IDENTIFY AND TREAT 'PILOT ERROR', PARTICULARLY, POOR PILOT JUDGMENT**

MAXINE E. LUBNER (Columbia University, NY) and LEWIS F. LESTER (Colby College, Waterville, ME) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 293-299. refs

A case-control survey is proposed to study rare events in order to identify high risk groups or risk factors, emphasizing those factors that are suitable for inclusion in an intervention or rehabilitation program. Factors would include judgment and decision making, personal disposition, attitude and personality, physical condition, and stress. Results of a preliminary study which support the inclusion of most of the risk factors in the model are presented. A psychoeducational rehabilitation program is also proposed, in which pilots who have experienced a survivable aviation event due to poor judgment or another risk factor will be taught using aeronautical decision making program techniques. The program would consist of four phases: assessment, education, individual counseling, and follow-up. R.B.

**A88-42960#****A STUDY OF PILOT DECISION MAKING USING MIDIS - A MICROCOMPUTER-BASED FLIGHT DECISION TRAINING SYSTEM**

A. STOKES, C. WICKENS, T. DAVIS, JR., B. BARNETT, R. ROSENBLUM (Illinois, University, Urbana) et al. IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 314-320. refs (Contract F33615-86-D-0514)

The construction of a computerized pilot decision making trainer/simulator known as MIDIS is described. The simulation is based upon an information processing model of human decision making, and presents problems, embedded in a coherent flight mission, that spans the breadth of different cognitive and attentional demands. In parallel, a battery of tests of cognitive strengths necessary for decision making is developed. The processing model of pilot judgment will be validated to the extent that pilots who have strengths on certain cognitive abilities, will perform well on decision problems that impose demands on those same abilities. Preliminary data collected on 9 instrument rated pilots are presented. Author

**A88-42961#****THE EVALUATION OF PILOT JUDGMENT DURING CERTIFICATION FLIGHT TESTS**

DENIS A. CARAVELLA (FAA, West Chicago, IL) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 328-336.

A method which evaluates five attitude patterns of pilots during certification tests to examine judgment in addition to skill is discussed. The attitude patterns studied are macho (aggressive/forceful vs. timid), attitude to authority (defiant vs. conformist), persistence (insistent vs. yielding), time of thought (impulsive vs. pondering), and fear (carefree vs. trepid). Examiners look for a balance between the two extremes of each pattern. With this method, a pilot could receive an unsatisfactory determination based on poor judgment, even if all tasks were performed successfully, possibly helping to pinpoint reasons for unsatisfactory performance resulting from poor attitude rather than a lack of skill. R.B.



**A88-42962#****THE EVALUATION OF PILOT JUDGMENT**

MICHAEL F. YOUNG (New Zealand Airline Pilots Association, Auckland) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 337-351. refs

A study to develop an evaluation system for pilot judgment using an instrument flight rules scenario containing nineteen judgment points and a visual flight rules scenario with nine judgment points is presented. Both scenarios simulate instances where weather conditions forced the pilot to deviate from the planned flight. The problem of defining pilot judgment is discussed and results of the study are given. It is found that decision making behavior is related to the type of pilot license held, the amount and type of initial and recurrent training and the type of flying most commonly done rather than total flight experience. R.B.

**A88-42963#****COCKPIT RESOURCE MANAGEMENT CONCEPTS AND TRAINING STRATEGIES - DEVELOPING AN ANALYSIS OF TRAINING NEEDS**

T. L. SAMS (American Airlines, Inc., Fort Worth, TX) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 360-371. refs

A study assessing Cockpit Resource Management (CRM) concepts, training media and instructional methods is presented. A questionnaire was sent to aviation psychologists, airline training directors, and pilots to provide statistics for respondent demographics, the importance of various CRM concepts, training effectiveness for each concept, and CRM training issues, including training media, instructional methods, assessment, and training problems and support. It was found that communications and command/leadership skills were felt to be most important, with very little interest taken in social and interpersonal skills. In the area of CRM media and instructional methods, priority was given to simulation, line-oriented flight training, small group seminars and video tape review of actual CRM case studies. R.B.

**A88-42964#****THE CAPTAIN'S MANAGERIAL TASKS**

ANDRE DROOG (Psychotechniek, Utrecht, Netherlands) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 372-378. refs

The roles which a captain has as leader of an air crew are analyzed and compared with the Mintzberg (1973) model for managerial work. Interpersonal, communication, and decisional roles are discussed. The managerial characteristics presented include work at an unrelenting pace, the performance of various brief and fragmented activities, preference for live action, attraction to the verbal media, use of a network of contacts outside his organization, and a blend of rights and duties. It is found that many characteristics of a manager are similar to those of a captain, with those of leader, monitor, disseminator, resource allocator, and disturbance handler being the most important. R.B.

**A88-42965#****CHANGING ATTITUDES THROUGH TRAINING - A FORMAL EVALUATION OF TRAINING EFFECTIVENESS**

CRAIG E. GEIS (U.S. Army, San Francisco, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 392-398. refs

A study using a specially designed human factors training program to measure attitudes regarding management of the cockpit is presented. A questionnaire evaluating cockpit management attitude was given to 838 Army pilots before and after training. The training program was designed to address human factor issues, using a variety of flight scenarios, simulator exercises, in-flight experiences, role play exercises and films. The training program resulted in a significant difference in attitude. It is found that the

training effort must be active and meaningful to the participants in order to be effective, and instructor selection is more important than the content of the training materials used. R.B.

**A88-42966\*#** Air Force Academy, Colo.**THE FORMATION PROCESS OF FLIGHT CREWS**

ROBERT C. GINNETT (U.S. Air Force Academy, Colorado Springs, CO) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 399-405. Research supported by Yale University. refs  
(Contract NCC2-324)

A study which uses Hackman's Normative Model (1986) for group effectiveness to see if there are any differences between the behaviors of effective and less effective captains at building and maintaining their crews is presented. Captains were selected using crew evaluations, creating a final pool of six effective crew managers and four captains less proficient as crew leaders. Data collection began at crew briefings, and continued through two trips, with intense data gathering during critical incidents for both task and process events. It was found that a predetermined set of interactions that can occur between crew members exists for the forming crew. It is concluded that effective captains expand the set of interactions, decreasing the limitations on how the group will work together. R.B.

**A88-42967\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.**COMMUNICATIONS INDEXES OF CREW COORDINATION**

BARBARA G. KANKI, H. CLAYTON FOUSHEE (NASA, Ames Research Center, Moffett Field, CA), and SANDRA LOZITO (San Jose State University, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 406-412. refs

Verbal exchanges occurring during task execution during full mission two-person simulator flights are used to study the effect of the interactive communication process on crew coordination and performance. The ratio of initiator to response speech is calculated and speech variations are recorded. The results of this study are compared with the findings of Ginnett's (1986) study of leaders. It is shown that low-error crews adopt a standard form of communicating, allowing for the ability to predict one another's behavior, facilitating the coordination process. The higher performance of crews that have flown together before is believed to be due to the increased amount of time for establishing a conventional means of communication. R.B.

**A88-42968\*#** San Jose State Univ., Calif.**'BUT CAPTAIN, I'VE BEEN DOING THIS A LOT LONGER THAN YOU HAVE' - THE EFFECTS OF 'ROLE-REVERSAL' ON CREW INTERACTION**

SANDRA C. LOZITO (San Jose State University, CA), BARBARA G. KANKI, and H. CLAYTON FOUSHEE (NASA, Ames Research Center, Moffett Field, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 413-418.

Legislation providing for airline deregulation has, among other things, created some ambiguity with respect to cockpit role structures. With the demise of some airlines, the absorption of others, the merging of seniority lists, and a new shortage of pilots, individuals with experience equivalent to or greater than that of the pilot in command may be placed in roles of lesser status. A formerly senior captain may be flying in the right seat as a first officer with an individual very much 'junior' in terms of both age and experience. Moreover, the mandatory retirement of airline pilots at age 60 does not apply to flight engineers, and some are 'down-grading' to fly in that capacity. The effects of this 'role-reversal' phenomenon on the crew coordination process have not been explored. The purpose of this study was to begin investigating this phenomenon using data obtained from a previous 'short-haul' full mission study conducted by Foushee, Lauber, Baetge, and Acomb (1986). Author

A88-42969#

**THE SYNERGY DIAMOND AS A MODEL FOR HUMAN BEHAVIOR (IN TEAM PROBLEM SOLVING SITUATIONS)**

CONRAD S. BIEGALSKI (USAF, Travis AFB, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 419-425.

A model is presented which can be used to depict short-term individual behavior patterns, how behavior affects the team's effort to develop synergy, positive and negative levels of synergy attainable, and how individuals can modify their behavior to increase their effectiveness as team members. It is noted that the diamond depicts short-term behavior, not attitude or personality. The main limitation of the 'synergy diamond' is that it is neither a graph nor a mathematical model. K.K.

A88-42970#

**COCKPIT RESOURCE MANAGEMENT - NEW DEVELOPMENTS AND TECHNIQUES**

WILLIAM R. TAGGART (Cockpit Resource Management, Austin, TX) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 433-439.

A model for developing a cockpit resource management (CRM) training design is presented. Issues pertaining to the design and implementation of CRM training are addressed. The key elements identified in the development of the CRM concept are initiative, inquiry, advocacy, conflict resolution, decision making, and critique. K.K.

A88-42971\*# Texas Univ., Austin.

**EVALUATING COCKPIT RESOURCE MANAGEMENT TRAINING**

ROBERT L. HELMREICH and JOHN A. WILHELM (Texas, University, Austin) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 440-446. refs (Contract NCC2-286)

The determinants of effective or ineffective cockpit resource management and the difficulties these multiple factors pose for validation of the effectiveness of cockpit resource management (CRM) training are discussed. A model of an evaluation design that may be applied to this type of training is presented. Concept validation is discussed as well as criteria for judging crew proficiency. Attention is given to accidents and proficiency checks, incidents and repeated maneuvers, attitude measurement, and self-report evaluation of training. K.K.

A88-42972\*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**SELECTION FOR OPTIMAL CREW PERFORMANCE - RELATIVE IMPACT OF SELECTION AND TRAINING**

THOMAS R. CHIDESTER (NASA, Ames Research Center, Moffett Field, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 473-479. Army-supported research. refs (Contract NCC2-286)

An empirical study supporting Helmreich's (1986) theoretical work on the distinct manner in which training and selection impact crew coordination is presented. Training is capable of changing attitudes, while selection screens for stable personality characteristics. Training appears least effective for leadership, an area strongly influenced by personality. Selection is least effective for influencing attitudes about personal vulnerability to stress, which appear to be trained in resource management programs. Because personality correlates with attitudes before and after training, it is felt that selection may be necessary even with a leadership-oriented training curriculum. R.B.

A88-42973#

**RISK ASSESSMENT AND THE PREDICTION OF STUDENT PILOT PERFORMANCE**

D. L. DOLGIN, G. D. GIBB (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL), and R. N. SHULL (U.S. Navy, Naval Aerospace Medical Institute, Pensacola, FL) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 480-485. refs

This paper describes an initial validation effort of a test for measuring risk-taking tendencies. It was hypothesized that willingness to take risks may contribute to success in flight training. One hundred and twenty one naval flight students selected for undergraduate pilot training were administered the risk test prior to entry into flight training. An additional group of 18 experienced naval pilots was tested for comparative purposes. Risk test measures were evaluated for correlation with the flight students' scores on the Navy's primary selection test battery. The significant results indicated that risk-taking was inversely related to success in naval aviation; nonsignificant trends indicated an opposite relation. Further research is needed to clarify results. Author

A88-42974#

**DYNAMIC VISUAL ACUITY IN THE SELECTION OF THE AVIATOR**

A. M. PRESTRUDE (Virginia Polytechnic Institute and State University, Blacksburg) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 486-492. refs

A review of research concerning dynamic visual acuity (DVA) is given, stressing the validity of DVA measures applied to performance based criteria in aviation. Characteristics of DVA examined include the relation of DVA to target velocity, individual differences in DVA and static visual acuity (SVA), the effect of observer movement, monocular versus binocular viewing, the correlation of DVA with SVA, the effect of illuminance and contrast, type of movement, practice and disuse, the effect of drugs, mechanisms of the velocity effect on DVA, and methods used in DVA research. Research concerning DVA and aviation include work on the effect of fatigue and target movement, camouflaged targets, implications for target detection, and the correlation between DVA and slant range scores of pilots who exhibited air-to-air detection at long slant ranges. Recommendations for further research are given, including the correlation of DVA to practice, equipment operation, fitness in the elderly, and DVA in the retinal periphery. R.B.

A88-42975#

**WONDROUS ORIGINAL METHOD FOR BASIC AIRMANSHIP TESTING**

STANLEY N. ROSCOE and LOUIS CORL (Illiana Aviation Sciences, Las Cruces, NM) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 493-499.

The Wondrous Original Method for Basic Airmanship Testing (WOMBAT), a method for measuring the physical skills and personality factors associated with flying through the performance of various tasks is presented. Tasks were chosen to minimize the degree to which their performance could be facilitated or impeded by participation in specific activities or by traumatic life events. Single-axis left-hand altitude tracking and dual-axis right-hand flight path tracking serve as the primary background task for other time-shared activities. Personality factors considered include aggressiveness, competitiveness, gamesmanship, conservatism, resistance to boredom, satisfaction with the routine, clarity and assertiveness of communication, and peer management potential. The applications of WOMBAT, particularly to the military, are also discussed. R.B.

A88-42976#

**THE BASIC ATTRIBUTES TESTS - AN EXPERIMENTAL SELECTION AND CLASSIFICATION INSTRUMENT FOR U.S. AIR FORCE PILOT CANDIDATES**

THOMAS R. CARRETTA (USAF, Human Resources Laboratory, Brooks AFB, TX) IN: International Symposium on Aviation



Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 500-507. refs

The usefulness of subtests of the Basic Attributes Test (BAT) in addition to the use of Pilot and Navigator-Technical composite scores from the Air Force Officer Qualifying Test (AFOQT) to select candidates for Undergraduate Pilot Training (UPT) is studied. The BAT experimental test battery consisting of eleven subtests measuring psychomotor skills and a variety of cognitive/perceptual abilities and personality/attitudinal characteristics believed to be related to pilot training performance was given to 930 Air Force officer candidates. Results are evaluated according to UPT performance standards and comparisons are made between AFOQT Pilot and Navigator-Technical composite scores alone, BAT scores alone, and a combination of the two. Results suggest the usefulness of several of the cognitive/perceptual subtests of the BAT, especially for specialized training assignment. R.B.

#### A88-42977#

##### **SIMULATOR AND AIRCRAFT TRAINING FOR OPTIMAL COMBAT PROFICIENCY**

JAMES W. DEES and LOUIS C. BYARS (U.S. Army, Aviation Center, Fort Rucker, AL) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 508-514.

Selected results are presented from a survey (Dees and Byars, 1987) of combat-experienced U.S. Army aviators regarding the amounts and proportions of simulator and aircraft training (after flight school) needed to achieve and maintain optimal combat proficiency levels among Army aviators. The design of the questionnaire and the statistical analysis techniques applied to the data are outlined, and the results are presented in extensive tables and compared with data on the present training program. It is recommended that flight training hours be increased significantly from current levels until simulators incorporating combat skills can be developed. T.K.

#### A88-42978#

##### **AN INTEGRATED INSTRUMENT/PRIVATE PILOT FLIGHT TRAINING PROGRAM**

HENRY L. TAYLOR, RICKY A. WEINBERG, OMER BENN (Illinois, University, Savoy), and ROBERT H. KAISER IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 515-521. refs

The design and effectiveness of a two-semester training program intended to qualify students for the FAA private pilot certificate with instrument rating are described. The program combines ground, simulator, and flight training and is based on the one-semester course of Kaiser et al. (1986), in which instrument skills are taught before contact skills. It is pointed out that all 30 h of simulator time and 47.6 of the 105 flight hours in the present course are conducted under IFR. All of the 12 students enrolled in the experimental course passed the private pilot flight test by the end of the first semester, and 9 of the 10 students continuing on to the second semester and taking the instrument flight test passed it as well. T.K.

#### A88-42979#

##### **THE ROLE OF THE FLIGHT INSTRUCTOR - AN IMPORTANT PSYCHOLOGICAL FACTOR IN FLYING TRAINING**

J. TERMOEHLEN IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 522-528.

#### A88-42980#

##### **ATTITUDES OF CANADIAN PILOTS TOWARDS PRIVATE PILOT FLIGHT TRAINING**

NEIL R. WINTHER (Manitoba, University, Winnipeg) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 529-536. refs

#### A88-42981#

##### **INSTRUCTION FOR MILITARY AIR INTERCEPT CONTROL**

LISA F. WEINSTEIN and GAVAN LINTERN (Illinois, University, Savoy) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 537-543. refs

A microcomputer simulation was used to teach military air-intercept control skills. Three experimental training methods were compared to the normal method in which students identify the bearing of the enemy fighter from a friendly fighter and then calculate an intercept heading. Part-training was employed to provide intensive training in critical component skills. Time-compressed training was provided to speed the simulation after the student provided a solution, so that many more practice trials could be given in each training session. A spatial visualization method of determining the intercept heading, that has the potential for being learned to the level of automaticity, was contrasted to the normal method of mathematical calculation. After training, all subjects were tested with the same whole, real-time scenario. Part training with time-compression and the spatial visualization method of determining intercepts was more effective than whole, real-time training with the calculation method of determining intercepts. The results suggest a substantial benefit from the combination of experimental techniques. Author

#### A88-42982#

##### **ASSESSMENT OF STUDENT ATTITUDES IN THE FLIGHT TRAINING ENVIRONMENT**

DAVID L. HOWELL (New Hampshire, University, Durham) and CATHERINE CASSELMAN VUKSANOVIC IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 544-549. refs

This study was designed to identify student attitudes toward their flight training program to determine if there was a change in student attitude from the beginning of a flight program to the end and to investigate variables that may have had an effect on student attitude toward their flight training program. Means were examined for both pre and post semester groups indicating a trend toward a positive change in attitude. Variables that held significance on the .05 level were the class in which the student was enrolled and students who intended to continue with the same flight instructor. Implications of instructor impact on student performance is discussed. Author

#### A88-42983#

##### **FLIR - WHAT YOU DON'T SEE IS WHAT YOU GET**

EDWARD A. STARK (Singer Co., Link Flight Simulation Div., Binghamton, NY) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 554-563.

An overview of the problems of developing training for FLIR systems is given, discussing FLIR characteristics and its use in developing skills in target acquisition and flight control. Skills required in the employment of FLIR systems such as knowledge of facts about essential parameters and relationships relating to the skill and environment in which FLIR is operated, differential responses to unique patterns of task-related information, the actions taken in fulfilling a task requirement, and the selection and implementation of actions fulfilling a mission requirement are discussed. Media employed in FLIR training and the requirements for effective training are evaluated. R.B.

#### A88-42984#

##### **SUBJECTIVE FATIGUE IN RELATION TO CIRCADIAN RHYTHMICITY AND REST-DUTY-CYCLE IN AIRCREW OPERATING ON THE ROUTE FRANKFURT-SAN FRANCISCO**

ALEXANDER SAMEL and HANS M. WEGMANN (DFVLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 579-586. Research supported by the Bundesministerium fuer Verkehr. refs

A88-42985#

**FLIGHT PERFORMANCE IN A DUAL AND SINGLE TASK CONDITION UNDER DRUG AND NO DRUG CONDITIONS - WHAT DOES THE SECONDARY TASK TELL US**

FRED C. HYMAN, HENRY L. TAYLOR, and CHRISTOPHER D. WICKENS (Illinois, University, Urbana) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 587-593. refs

The effect of various drugs on the resource allocation between a pilot's primary and secondary task was evaluated by three experiments in which drugs were administered to pilots performing both a primary task (flying a flight simulator) and a secondary task (taking the Sternberg memory scanning test). Experiments were conducted for the cases of the administration of alcohol, combinations of antiemetics, and domperidone (a D2 dopamine antagonist). The lack of effect of the Sternberg task upon the flight task suggests that it may be unsuitable as a secondary task within this methodology. R.B.

A88-42986#

**PILOTS' ATTITUDES TOWARD ALCOHOL USE AND FLYING**

SUSAN M. ROSS and LEONARD E. ROSS (Wisconsin, University, Madison) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 594-596.

A survey asking questions concerning flying experience, drinking behavior, and attitudes toward alcohol and marijuana use in flying and driving situations was sent to a sample of 2,000 pilots. The 1169 usable surveys returned were used to determine pilots drinking and drug use behavior and the time pilots felt to be safe between drinking or smoking marijuana and flying or driving. The blood alcohol content pilots might have while flying and driving is estimated. It is found that pilots clearly distinguish between driving and flying with respect to alcohol and marijuana use, and are much more cautious about flying than driving. If the respondents behave according to their expressed attitudes, few would be expected to fly with a blood alcohol content near 0.04 percent (the legal limit), although a substantial percentage would drive with a blood alcohol content between 0.04 and 0.10 percent, a level at which impairment would be expected. R.B.

A88-42987\*# Old Dominion Univ., Norfolk, Va.

**TIME-LOCKED TIME-HISTORIES - A NEW WAY OF EXAMINING EYE-MOVEMENT DATA**

J. RAYMOND COMSTOCK, JR., GLYNN D. COATES, RAYMOND H. KIRBY (Old Dominion University, Norfolk, VA), and RANDALL L. HARRIS, SR. (NASA, Langley Research Center, Hampton, VA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 597-601. refs (Contract NAG1-451)

A problem often encountered when eye-movement measurement is conducted is the choice of 'indices' or 'statistics' available to present such information. The present study reports the use of the Time-Locked Time-History as a technique of value in the examination and presentation of eye-movement data. Plots created using this technique are labeled time-locked time-histories as they illustrate subject eye lookpoint during a period of time before and after a certain time-locking event. Events that occur with some degree of repetition, such as the onset or termination of control activities, warning signals, or changes in indicator positions may be utilized as time-locking events. The present study reports the use of this technique in an eye-movement study using a secondary task in which the subject must discriminate specific types of information in the display. Author

A88-42988\*# Illinois Univ., Urbana.

**ATTENTION IN AVIATION**

CHRISTOPHER D. WICKENS (Illinois, University, Urbana) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State

University, 1987, p. 602-608. refs (Contract NAG2-308)

The relevance of four principles or mechanisms of human attention to the design of aviation systems and the performance of pilots in multitask environments, including workload prediction and measurement, control-display integration, and the use of voice and head-up displays is discussed. The principles are: the mental energy that supplies task performance (resources), the resulting cross-talk between tasks as they are made more similar (confusion), the combination of different task elements (integration), and the way in which one task is processed and another is ignored (selection or tunneling). The introduction of greater levels of complexity into the validation of attentional theories in order to approach the demands of the cockpit or ATC console is proposed. R.B.

A88-42989#

**CONCURRENT VALIDATION OF FOUR WORKLOAD AND FATIGUE MEASURES**

V. GAWRON, J. BALL (Calspan Corp., Buffalo, NY), S. SCHIFLETT, T. SLATER, and J. MILLER (USAF, School of Aerospace Medicine, Brooks AFB, TX) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 609-615. Army-supported research. refs

Pilot workload was assessed in a large flight test using the Total In-Flight Simulation (TIFS) aircraft. This aircraft was used as both a ground and in-flight simulator supplying appropriate control feel, handling characteristics, and cockpit instrumentation for a tactical-transport simulation. Twenty-one C-130 pilots each flew one familiarization and four data flights. The measures of aircrew workload and fatigue recorded in this study included: (1) SWAT ratings of time load, mental effort, and psychological stress during taxi-out and taxi-in as well as before and after a simulated airdrop, (2) Subjective Fatigue Checklist ratings of workload and fatigue recorded immediately after the SWAT ratings, (3) Profile of Mood States values for vigor and fatigue recorded after the flight, and (4) Sleep Survey ratings of amount of sleep required. All these measures have been used to assess workload and/or fatigue in the past but have never been recorded concurrently. Intercorrelation matrices are presented as well as test-retest reliabilities. Author

A88-42991#

**EVOKED RESPONSE, PERFORMANCE AND SUBJECTIVE MEASURES IN A LINGUISTIC PROCESSING TASK**

GLENN F. WILSON (USAF, Harry G. Armstrong Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH), KATHY MCCLOSKEY, and IRIS DAVIS (Systems Research Laboratories, Inc., Dayton, OH) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 623-629. refs

The processing requirements of a linguistic task shown to have three difficulty levels are investigated. The task was validated on the basis of reaction time and subjective report data. EEG data together with eyeblink, heart rate, and muscle tension data were used to further describe the processing demands of this task. The evoked potential results obtained from the EEG revealed that the amplitude of an early positive component increased from the high to the low levels of the task. The amplitude of a late positive component decreased and its latency increased as the task became more difficult. K.K.

A88-42992\*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**INDIVIDUAL DIFFERENCES AND SUBJECTIVE WORKLOAD ASSESSMENT - COMPARING PILOTS TO NONPILOTS**

MICHAEL A. VIDULICH (NASA, Ames Research Center, Moffett Field, CA) and PARIMAL PANDIT (San Jose State University, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 630-636. refs

Results by two groups of subjects, pilots and nonpilots, for

two subjective workload assessment techniques (the SWAT and NASA-TLX tests) intended to evaluate individual differences in the perception and reporting of subjective workload are compared with results obtained for several traditional personality tests. The personality tests were found to discriminate between the groups while the workload tests did not. It is concluded that although the workload tests may provide useful information with respect to the interaction between tasks and personality, they are not effective as pure tests of individual differences. R.R.

**A88-42993\*#** Army Aviation Research and Development Command, Moffett Field, Calif.

#### **INFLIGHT EVALUATION OF PILOT WORKLOAD MEASURES FOR ROTORCRAFT RESEARCH**

ROBERT J. SHIVELY (U.S. Army, Aeroflightdynamics Directorate, Moffett Field, CA), MICHAEL R. BORTOLUSSI (Western Aerospace Laboratories, Inc., Moffett Field, CA), VERNOL BATTISTE, SANDRA G. HART (NASA, Ames Research Center, Moffett Field, CA), DAVID D. PEPITONE (San Jose State University, CA), and JOY HAMERMAN MATSUMOTO IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 637-643. refs

The effectiveness of heart-rate monitoring and the NASA TLX workload rating scale (Hart et al., 1985) in measuring helicopter-pilot workloads is investigated experimentally. Four NASA test pilots flew two 2-h missions each in an SH-3G helicopter, following scenarios with takeoff, hover, cross-country, and landing tasks; pilot performance on the tasks undertaken near the landing area was measured by laser tracking. The results are presented in graphs and discussed in detail, and it is found that the TLX ratings clearly distinguish the flight segments and are well correlated with the performance data. The mean heart rate (measured as interbeat interval) is correlated ( $r = -0.69$ ) with the TLX workload, but only the standard deviation of the interbeat interval is able to distinguish between flight segments; the correlation between standard deviation and TLX ratings is negative but not significant. T.K.

**A88-42994#**

#### **COMPARISON OF POSWAT RATINGS FOR AIRCRAFT AND SIMULATOR WORKLOAD**

CARL J. MALLERY and JEFFERY L. MARESH (Ohio State University, Columbus) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 644-650.

The Pilot Objective/Subjective Workload Assessment Technique (POSWAT) is discussed and a study to compare POSWAT ratings obtained in a simulator to those obtained in an aircraft is presented. POSWAT is an on-flight workload evaluation technique which has the pilot press a numbered button on a kneeboard at one-minute intervals to indicate workload. Workload is defined as all the physical and mental effort exerted to fly including planning, cross-checking, thinking, navigating systems monitoring, communicating, and controlling the aircraft. The comparison study uses twenty volunteer current instrument rated pilots categorized according to experience level. Some results of the simulator portion of the study are presented, showing higher POSWAT ratings for pilots with less experience. R.B.

**A88-42995\*#** National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

#### **MEASURING MOMENT-TO-MOMENT PILOT WORKLOAD USING SYNCHRONOUS PRESENTATIONS OF SECONDARY TASKS IN A MOTION-BASE TRAINER**

MICHAEL R. BORTOLUSSI (Western Aerospace Laboratories, Inc., Moffett Field, CA), SANDRA G. HART, and ROBERT J. SHIVELY (NASA, Ames Research Center, Moffett Field, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 651-657.

A simulation was conducted to determine whether the sensitivity of secondary task measures of pilot workload could be improved by synchronizing their presentation to the occurrence of specific

events or pilot actions. This synchronous method of presentation was compared to the more typical asynchronous method, where secondary task presentations are independent of pilot's flight-related activities. Twelve pilots flew low- and high-difficulty scenarios in a motion-base trainer with and without concurrent secondary tasks (e.g., choice reaction time and time production). The difficulty of each scenario was manipulated by the addition of 21 flight-related tasks superimposed on a standard approach and landing sequence. The insertion of the secondary tasks did not affect primary flight performance. However, secondary task performance did reflect workload differences between scenarios and among flight segments within scenarios, replicating the results of an earlier study in which the secondary tasks were presented asynchronously (Bortolussi et al., 1986). Author

**A88-42996#**

#### **THE SPONTANEOUS EYE BLINK IN WORK LOAD ASSESSMENT**

JOHN A. STERN (Washington University, Saint Louis, MO) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 658-677. refs

The results of studies conducted under laboratory, flight simulation, and field conditions to demonstrate how aspects of spontaneous eye blink are affected by task demands are given, reviewing blink frequency, waveform, and timing with respect to environmental and internal events. More demanding visual perceptual tasks lead to greater blink inhibition. Blink waveform as defined by closure duration is affected by perceptual input modality, task difficulty, expectancy, and time-on-task effects. Tasks where information is heard rather than seen lead to longer blink closure durations. Higher workload visual tasks result in a shorter average blink duration. Blink timing is affected by the perceptual/cognitive load placed on the operator. Blinks are deferred to later time points as load increases. It is concluded that physiological measures such as eye blinks are an important data base which can help human factors specialists evaluate aspects of information intake and processing, and effects related to attention and fatigue. R.B.

**A88-42998#**

#### **MULTIDIMENSIONAL SCALING ANALYSIS OF SIMULATED AIR COMBAT MANEUVERING PERFORMANCE DATA**

DONALD J. POLZELLA and GARY B. REID (USAF, Harry G. Armstrong Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 683-689. refs

This paper describes the decomposition of air combat maneuvering by means of multidimensional scaling (MDS). MDS analyses were applied to performance data obtained from expert and novice pilots during simulated air-to-air combat. The results of these analyses revealed that the performance of expert pilots is characterized by advantageous maneuverability and intelligent energy management. It is argued that MDS, unlike simpler metrics, permits the investigator to achieve greater insights into the underlying structure associated with performance of a complex task. Author

**A88-42999#**

#### **THE RELATIVE UTILITY OF VARIOUS TYPES OF PERFORMANCE MEASURES FOR AIRCREW TRAINING AND EVALUATION**

MARTY R. ROCKWAY (Dayton, University, Williams AFB, AZ) and ROBERT T. NULLMEYER (USAF, Human Resources Laboratory, Williams AFB, AZ) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 690-697.

Measurement and methodological issues relevant to the evaluation of aircrew training methods, media, and students are identified and discussed. These issues are illustrated using data and examples taken from C-130E WST training effectiveness

studies. Consideration is given to the relationships among the types of measures used, the relative utility of subjective versus objective data, the distinction between human and system performance, and the potential capabilities and limitations of automated performance measurement systems. K.K.

### A88-43000#

#### INADEQUACY OF ROOT MEAN SQUARE ERROR AS A PERFORMANCE MEASURE

DAVID C. HUBBARD (Dayton, University, Higley, AZ) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 698-704. refs

Methods for summarizing pilot performance within a specified course segment are compared, including the mean error of scores (ME), standard deviation of error scores (SDE) and the root mean square error (RMSE) which is completely defined by ME and SDE. A performance experiment investigating the effect of different display systems on pilot performance of an aerial refueling task is presented and results are analyzed in two different ways: a multivariate analysis of RMSE scores followed by univariate analysis and a multivariate analysis followed by a univariate analysis of ME and SDE scores. It is concluded that ME and SDE together contain more information about performance than RMSE alone or RMSE combined with either ME or SDE and it is suggested that RMSE should not be used as a performance metric because it can hide important difference in performance. R.B.

### A88-43001\*# Ohio State Univ., Columbus.

#### A COMPARISON OF ONE- AND TWO-PERSON CREW PERFORMANCE IN A SUPERVISORY CONTROL TASK

R. ALLEN MILLER, RICHARD J. JAGACINSKI, BRIAN D. PLAMONDON, LYNN E. LYTTON, and ALEX C. KIRLIK (Ohio State University, Columbus) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 705-711.

(Contract NAG2-195)

One- and two-person crews performed a simulated supervisory control task in which they had to directly control a scout helicopter and indirectly control four friendly helicopters in a hostile environment. One-person crews relied on an autopilot more than two-person crews in order to deal with multiple task demands. However, two-person crews were superior in terms of overall performance, and on particular subtasks such as searching for cargo and enemy craft and destroying enemy craft after they were located. Author

### A88-43002#

#### GENERAL AVIATION PILOT ERROR MODELING - AGAIN?

THOMAS H. ROCKWELL and WALTER C. GIFFIN (Ohio State University, Columbus) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 712-720. refs (Contract DOT-RS57-85-C-00101)

Models for decisional types of common pilot errors were developed and tested against their ability to explain a large percentage of accidents of a specific type, spell out specific research needed to understand and verify model elements, and specify implementable countermeasures to reduce the probability of pilot error. Conceptual 'process' models were created for three types of error: VFR flight into instrumental meteorological conditions, pilot fuel mismanagement, and pilot response to critical inflight events. The use of the FAA Accident/Incident Data System in developing the models is also discussed. R.B.

### A88-43003\*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

#### SUBJECTIVE, PHYSIOLOGICAL, AND PERFORMANCE MEASURES OF EIGHT PRIMARY FLIGHT DISPLAYS

TERENCE ABBOTT, MARK NATAUPSKY, and GEORGE STEINMETZ (NASA, Langley Research Center, Hampton, VA) IN:

International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 721-727. refs

A simulator study to determine the effect on pilot performance of electronically represented altitude and airspeed information on the primary flight display using moving tape formats is presented. The study used a seemingly random, unpredictable guidance task and focused on three areas relating to the representation of information on moving tape formats: tape centering, trend information, and tape orientation. Results suggest that moving tape displays with actual values centered is better than tapes with reference values centered and that high-to-low airspeed tape orientation is better than low-to-high orientation. With trend information absent, subjects devoted 50 percent more attention to the secondary task relative to display configurations with trend presented. R.B.

### A88-43004#

#### 'WERE YOU DISTRACTED BY THE OTHER PLANE'S SUDDEN APPEARANCE?' - THE CASE FOR STANDARDIZED POST-ACCIDENT INTERVIEWS FOR AIR TRAFFIC CONTROLLERS

DARLENE A. COUCHMAN (New Mexico State University, Las Cruces) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 733-738. refs

The problem of obtaining early information after accidents is examined, arguing that a standardized set of questions, to be asked of air traffic controllers immediately after an accident, should be designed and implemented to reduce the distortion that occurs due to the influence of past experiences and published or broadcasted news reports of the event. Relevant studies concerning memory, post-accident questionnaires in use, and the need for a preliminary study to develop a standardized questionnaire are discussed, including possible sample questions. It is proposed that a neutral organization such as the FBI should be responsible for isolating and interviewing air traffic controllers, whether or not they could have had a role in the accident. R.B.

### A88-43005#

#### PERSONAL CHARACTERISTICS RELATED TO ACCIDENT HISTORIES OF CANADIAN PILOTS

PETER H. PLATENIUS and GERALD J. S. WILDE (Kingston, Queen's University, Canada) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 739-745. Research supported by the Canadian Aviation Safety Board. refs

A study using a pilot survey to identify personal characteristics of aircraft pilots which might be used as a 'psychological checklist,' allowing for a later assessment of the degree to which self-reported characteristics statistically associated with past accidents can be used to predict future accidents is presented. Characteristic include life events and preoccupations, risk acceptance, humor appreciation, hobbies, medical symptoms, self perception, initiative or self control, loneliness, alcohol use, and automobile driving records. About 70 percent of survey respondents were correctly classified according to the accident criterion. R.B.

### A88-43006#

#### A METHODOLOGICAL APPROACH TO THE SEARCH FOR INDIRECT (HUMAN) EVENTS RELATED TO MISHAPS

KINGSLEY M. HENDRICK (Transportation Safety Institute, Oklahoma City, OK), LUDWIG BENNER, JR. (Events Analysis, Inc., Oakton, VA), and RUSSELL LAWTON (AOPA Air Safety Foundation, Frederick, MD) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 753-760. refs

The application of sequentially timed events plotting (STEP), a disciplining methodology based on multilinear events sequencing to document and display human decision events associated with accidents to improve decision making in aviation is discussed.

The STEP methodology can document the recurrence of specific decision making events and can assist the development of hypotheses from observation and documentation. Hypotheses generated using the methodology call for careful examination of concrete observations of events rather than abstract conclusions about phenomena. The DECIDE decision making model, developed for hazardous material transportation, was modified during refinement of the STEP methodology and was applied to the pilot decision making process. R.B.

#### A88-43007#

##### ROOT CAUSES OF HELICOPTER PILOT ERROR ACCIDENTS

RICHARD J. ADAMS (Advanced Aviation Concepts, Inc., Robbinsville, NJ) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 761-767. refs

Historically, a very high percentage of helicopter accidents are related to 'pilot error'. An examination of the underlying root causes of these accidents was performed. Helicopter pilots were interviewed throughout the U.S. regarding their perception of the hazards associated with a wide range of operations. This information was compared to accident data and reports from NTSB, the FAA, the U.S. Army and Canada. Author

#### A88-43418

##### PERCEPTION OF SHAPE FROM SHADING

V. S. RAMACHANDRAN (California, University, La Jolla) Nature (ISSN 0028-0836), vol. 331, Jan. 14, 1988, p. 163-166. Research supported by the University of California. refs

Several findings are presented which may help reveal computational mechanisms underlying the ability of the human visual system to perceive shape from shading. It is found that perception of shape from shading is a global operation which assumes that there is only one light source illuminating the entire visual image. This implies that if two identical objects are viewed simultaneously and illuminated from different angles, three-dimensional shape would be perceived accurately in only one of them at a time. Second, three-dimensional shapes that are defined exclusively by shading can provide tokens of the perception of apparent motion, suggesting that the motion mechanism is remarkably versatile in the kinds of inputs it can use. Finally, the occluding edges which delineate an object from its background can also powerfully influence the perception of three-dimensional shape from shading. C.D.

#### A88-43427

##### PERCEPTION OF THREE-DIMENSIONAL STRUCTURE FROM MOTION IN MONKEY AND MAN

R. M. SIEGEL and R. A. ANDERSEN (Salk Institute for Biological Studies, La Jolla, CA) Nature (ISSN 0028-0836), vol. 331, Jan. 21, 1988, p. 259-261. NIH-supported research. refs

Novel, highly controlled motion stimuli have been developed to use with psychophysical and physiological techniques to study how three-dimensional structure is obtained from motion. It is shown that the Rhesus monkey can detect three-dimensional structure from motion in the same way as human subjects. Furthermore, the dependence of both species on certain parameters of the display shows that information is integrated both spatially and temporally for this higher visual function. C.D.

#### A88-44205

##### THE PROBABILITY OF INTERRUPTIONS IN A CONTROL SYSTEM AS A CRITERION OF STRESS IN OPERATOR ACTIVITY [VEROIATNOST' NARUSHENII V SISTEME UPRAVLENNIA KAK KRITERII NAPRIAZHENNOSTI OPERATORSKOI DEIATEL'NOSTI]

M. A. GRITSEVSKII, L. S. BASHKIROVA, T. N. DOLGOLENKO, I. U. V. EGOROVA, V. V. GLOTOV (Institut Gigieny Truda i Profzabolevanii, Gorki, USSR) et al. Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, May-June 1988, p. 424-427. In Russian. refs

The relationship between the functional status of an operator of a new automated actuating complex and the frequency of

significant interruptions in the work process which caused work stoppage is examined. The activity of operators, (which was monitored by taking periodic photographs), consisted mainly in regulating technical parameters a great number of which had to be kept permanently in the memory. During a normal work process, regulating activity occupied up to 32 percent of the operator's activity, but this percentage went up to 90 percent following each stop or start (whether accidental or planned) in the technological process, leading to sharp increases of errors and of stress-related physiological symptoms. The results suggest the necessity of an intensification of operator training for start-up operations and for different variants of emergency situations. I.S.

#### A88-44206

##### LOCALIZED HEAT REDUCTION AS A WAY TO MAINTAIN THE LEVEL OF WAKEFULNESS IN A HUMAN OPERATOR DURING MONOTONOUS ACTIVITY [LOKAL'NYI TEPLOS'EM KAK SPOSOB PODDERZHANIYA UROVNIYA BODRSTVOVANIYA CHELOVEKA-OPERATORA PRI MONOTONNOI DEIATEL'NOSTI]

I. S. SHENDEROVA (Institut Gigieny Truda i Profzabolevanii, Gorki, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 14, May-June 1988, p. 428-433. In Russian. refs

The effect of localized cooling of a small skin area (5.3 sq cm on the forehead by a plate which was cooled thermoelectrically to 5 C below skin temperature) on the functional status of an operator engaged in monotonous activity was investigated. In the course of the first 7 min of the experiment, the subject was presented with eight combinations of colored light flashes (to six of which he had to react by pressing a button), followed by a 30 min period during which white-light flashes were presented every 3 min, and then (unexpectedly) by a 5.5-min-long presentation of colored combinations. The functional status of subjects in the control and the 'cooled' states was evaluated using EEG and ECG parameters and the time of sensorimotor reactions. In addition, the subjects were asked to fill out a questionnaire. It was found that cooling of forehead skin increased the level of alertness. Thus, the time of reaction was stabilized or shortened, the number of errors decreased, and the EEG major rhythms changed favorably. I.S.

#### A88-45353\*

##### Old Dominion Univ., Norfolk, Va. VISUAL FIELD INFLUENCE ON MANUAL ROLL AND PITCH STABILIZATION

J.-K. HUANG (Old Dominion University, Norfolk, VA) and L. R. YOUNG (MIT, Cambridge, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, July 1988, p. 611-619. refs

(Contract NSG-2032; NAG2-12; NAG2-88; NAG2-445)

Human control performance in nulling perceived tilt angles was investigated for combinations of pseudo-random vestibular disturbances and different waveforms of low frequency wide visual field motions. For both roll and pitch axes, subjects tilted the trainer in which they were seated in the direction of field rotation. This visual bias was much stronger for pitch backwards with upward field rotation. Frequency response analysis showed the dominance of visual cues at low frequencies (below 0.06 Hz) and the reliance on vestibular information in the high frequency range for both axes. Models suggest that operator balancing responses at high frequencies are mainly processed by the semicircular canals rather than the otolith organs. The results also suggest that the subject tends to rely less on the otolith organs for pitch perception than for roll. Author

#### A88-45357

##### UTILIZATION OF PSYCHOMOTOR SCREENING FOR USAF PILOT CANDIDATES - ENHANCING PREDICTIVE VALIDITY

RICHARD H. COX (Ball State University, Muncie, IN) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, July 1988, p. 640-645. refs

(Contract F49620-85-C-0013)

The results of the Two Hand Coordination and Complex Coordination psychomotor tests performed on 320 prospective

pilots were analyzed to determine ways in which the validity of these tests could be enhanced for predicting the USAF Undergraduate Pilot Training (UPT) outcome. Independent variables included five basic error measures associated with the two tests, and seven new variables not previously utilized. The results of MANOVA and multiple regression analyses indicated that performance on the two tests was significantly related to the UPT outcome. Regressing the basic five independent variables on UPT outcome yielded R values of 0.334, 0.271, and 0.310 for early, late, and total trial data, respectively. A stepwise multiple regression analysis revealed that the best two-variable prediction equation included the hypotenuse of horizontal and vertical error for both psychomotor tests. I.S.

**A88-45362****OBJECTIVE PSYCHOLOGICAL TESTING OF U.S. AIR FORCE OFFICERS IN PILOT TRAINING**

PAUL D. RETZLAFF and MICHAEL GIBERTINI (Mental Health Clinic, Reese AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, July 1988, p. 661-663. refs

Clinical psychologists are increasingly assisting flight surgeons in the assessment of students in pilot training. However, some psychological tests reported in the literature are ill-suited to efficient clinical evaluation of aviators. Recent advances in clinical psychometrics offer improvements in reliability, personality theory, and norms. The Multidimensional Aptitude Battery, the Personality Research Form, and the Millon Clinical Multiaxial Inventory were administered to 350 Air Force officers undergoing undergraduate pilot training. Normative data are presented for use by practitioners assessing similar populations. Author

**N88-24152\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**SPATIAL COGNITION**

MARY KISTER KAISER and ROGER REMINGTON *In its Space Station Human Factors Research Review. Volume 4: Inhouse Advanced Development and Research* p 77-83 May 1988 Avail: NTIS HC A07/MF A01 CSDL 051

Spatial cognition is the ability to reason about geometric relationships in the real (or a metaphorical) world based on one or more internal representations of those relationships. The study of spatial cognition is concerned with the representation of spatial knowledge, and our ability to manipulate these representations to solve spatial problems. Spatial cognition is utilized most critically when direct perceptual cues are absent or impoverished. Examples are provided of how human spatial cognitive abilities impact on three areas of space station operator performance: orientation, path planning, and data base management. A videotape provides demonstrations of relevant phenomena (e.g., the importance of orientation for recognition of complex, configurational forms). The presentation is represented by abstract and overhead visuals only. Author

**N88-25142#** Georgia Inst. of Tech., Atlanta. Center for Man-Machine Systems Research.

**HUMAN PROBLEM SOLVING IN COMPLEX DYNAMIC ENVIRONMENTS Interim Report, Jun. 1984 - May 1985**

WILLIAM B. ROUSE and RICHARD L. HENNEMAN Dec. 1987 65 p

(Contract MDA903-82-C-0145; DA PROJ. 2Q1-61102-B-74-F) (AD-A190788; ARI-RN-87-84) Avail: NTIS HC A04/MF A01 CSDL 23B

This research note summarizes three years of a four year contract to study ways of improving human performance in highly integrated systems in such areas as communications, transportation, manufacturing, etc. Rule-based computer models of human performance (CAIN) are discussed, as are methods from measuring the complexity of the task of monitoring these large-scale systems. Finally, the development of a computer model (MABEL) which requires subjects to monitor a large-scale communications network is described. GRA

**N88-25143#** Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

**EYE AND HEAD RESPONSE TO AN ATTENTION CUE IN A DUAL TASK PARADIGM Final Report, Apr. - Dec. 1984**

GLORIA L. CALHOUN Jul. 1987 49 p (AD-A191052; AAMRL-TR-87-033) Avail: NTIS HC A03/MF A01 CSDL 05H

Eight subjects were used to characterize eye and head movements in response to a cue to refixate in a dual task paradigm. The subject's tasks were complete a centrally located pursuit tracking task and identify targets which were vertically displaced from the normal line-of-sight. Reaction time and movement pattern of the eye and head were recorded as well as conventional performance measures for the following: 1) two difficulty levels of the tracking task; 2) presence and absence of an attention cue prior to target presentation; and 3) two target locations which were vertically displaced from the centrally located task. The results indicated that eye and manual reaction time increase the farther a target is vertically displaced from the centrally located task and head reaction time decreases with the presence of a verbal cue prior to target presentation. Since the experimental conditions examined in the present study affected these measures differently, eye, head, and manual reaction times should be examined further. The differences found in eye and head response as a function of information location and presence of an attention cue suggest that such unobtrusive measures may be valuable in the design of multifunction display symbology and attention cueing systems. GRA

**N88-25144#** Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

**A FRAMEWORK FOR A THEORY OF MAPPING Interim Report, Mar. 1986 - Mar. 1987**

ALLAN COLLINS and MARK BURSTEIN Dec. 1987 27 p (Contract MDA903-85-C-0411; DA PROJ. 2Q1-61102-B-74-F) (AD-A191071; ARI-RN-87-64) Avail: NTIS HC A03/MF A01 CSDL 05H

The literature on similarity, analogy, and metaphor ranges over many different kinds of mappings. Some of the disagreements arise because researchers are talking about different kinds of mappings or the different contexts in which mappings are made. Our goal is to clarify the issues being addressed and the critical distinctions that need to be made. We will attempt to consider the entire territory over which the discussion of mapping arises, but no doubt we will miss some of the critical distinctions and issues. We have divided the paper into three main sections. The first section distinguishes the different kinds of entities that are related by analogy and similarity mappings, some of their more salient properties. The second section discusses the different contexts or tasks that give rise to mappings. The third section catalogues the set of issues we have identified in the literature, and identifies some of the different solutions proposed or possible for each issue. In a concluding section we briefly discuss the implications of this framework for research. GRA

**N88-25145#** Illinois Univ., Urbana.

**PERFORMANCE EFFECTIVENESS AND THE WORK/REST CYCLE Final Report, 1 Oct. 1983 - 31 Dec. 1987**

DAVID BIRCH 1 Feb. 1988 17 p

(Contract DAAG29-83-K-0138) (AD-A191448; ARO-21059.6-LS) Avail: NTIS HC A03/MF A01 CSDL 06D

The supervisor-monitor of a modern automated system is called upon to perform continuously a variety of cognitive tasks over prolonged periods of time. Such work is structured by the characteristics of the system, by the particular requirements of the individual tasks to be carried out, and by the motivational and cognitive processes that take place as the work goes on. It is useful to refer to the scheduling of these events and to inquire about the structure of work that emerges as a consequence of this scheduling. Six new studies directed to the understanding of how scheduling of events occurs in continuous work have resulted in significant progress theoretically on problems of scheduling and



in applications of the theory. New models and extensions of existing models to the continuous behavioral situation are reported. Three other studies, each addressed to different aspects of the structure of tasks as determined by motivation and cognition, provide new information about continuous work in three different settings: during single-task and dual-task tracking, while making predictions of system criterion values from multiple cue values that differ in validity and redundancy, and while judging similarities of visual inputs from symbolic representations of the stimuli. GRA

**N88-25146#** California Univ., Los Angeles. Motor Control Lab.  
**OPTIMIZING FEEDBACK UTILIZATION IN MOTOR SKILL TRAINING Interim Report, Jun. 1985 - Jun. 1986**  
RICHARD A. SCHMIDT and DIANE C. SHAPIRO Feb. 1988  
38 p  
(Contract MDA903-85-K-0225; DA PROJ. 2Q1-61102-B-74-F)  
(AD-A191559; ARI-RN-88-05) Avail: NTIS HC A03/MF A01  
CSCS 051

This research note deals with the acquisition of motor skills, specifically with the optimal use of feedback on goal achievement (termed Knowledge of Results, KR) for the maximization of learning and retention. A great deal of evidence suggests that enhancing the amount or quality of KR can improve performance in a session where KR is present, but limited evidence suggests that this might not be effective on a delayed criterion test when KR is removed -- a typical goal of many Army training settings. Two variations of KR were studied: relative frequency - the proportion of trials receiving KR, and summary KR - where KR is given about an entire set of trials. In each case, alterations in KR which degraded training performance (relative to a condition with KR on each trial) actually produced enhanced performance on a delayed no-KR retention test. A third paradigm examined the learning of error-detection capabilities as a basis for these effects. Overall, six experiments suggest that enhancing KR in acquisition may generate KR overreliance, preventing the learning of important features of the task which are critical for retention of performance when feedback is removed or degraded (e.g. in marksmanship). Our results have implications for improved feedback in training. GRA

**N88-25147#** California Univ., Irvine. Dept. of Information and Computer Science.  
**MODELS OF INCREMENTAL CONCEPT FORMATION Interim Report, Mar. 1986 - Mar. 1987**  
JOHN H. GENNARI, PAT LANGLEY, and DOUG FISHER Feb. 1988 33 p  
(Contract MDA903-85-C-0324; DA PROJ. 2Q1-61102-B-74-F)  
(AD-A191597; ARI-RN-88-06) Avail: NTIS HC A03/MF A01  
CSCS 05H

This document reviews three previous models of incremental concept formation and presents a model, CLASSIT, that extends these earlier systems. All of the models integrate the process of recognition and learning, and all can be viewed as carrying out a search through the space of possible concept hierarchies. In an attempt to show that CLASSIT is a robust model of concept formation, empirical studies of the system's behavior under a variety of conditions are also presented. GRA

**N88-25148#** California Univ., Berkeley. Dept. of Psychology.  
**VISUAL INFORMATION PROCESSING IN THE PERCEPTION OF FEATURES AND OBJECTS Annual Technical Report No. 1, 1 Jan. - 31 Dec. 1987**  
ANNE TREISMAN 22 Jan. 1988 23 p  
(Contract AF AFOSR-0125-87)  
(AD-A192026; AFOSR-88-0215TR) Avail: NTIS HC A03/MF A01  
CSCS 17K

The first year of the grant was spent in setting up the laboratory, and in starting research on a number of different projects. All are concerned with the visual processing of information in the perception of objects. A series of experiments has explored the perception of conjunctions of features, attempting to determine what makes this difficult or easy. A new method (detection of apparent motion) was tested and a modification of

feature-integration theory was developed to accommodate the new results. Other projects have been concerned with coding of features, finding evidence for modularity, testing the level of abstraction at which features (such as orientation) are coded, the different media which support the coding of shape, and the space in which they are represented (retinal or three-dimensional). Another project has probed the effects of perceptual learning with extended practice at detecting particular sets of targets; the results suggest that automatization in search is highly specific to the practiced task and has little effect on other perceptual tests. GRA

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## MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

**A88-42642\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.  
**ROBOTIC VISION/SENSING FOR SPACE APPLICATIONS**  
KUMAR KRISHNEN, OLIN GRAHAM (NASA, Johnson Space Center, Houston, TX), and RUI J. P. DE FIGUEIREDO (Rice University, Houston, TX) IN: 1987 IEEE International Conference on Robotics and Automation, Raleigh, NC, Mar. 31-Apr. 3, 1987, Proceedings. Volume 1. Washington, DC, IEEE Computer Society Press, 1987, p. 138-150. refs  
(Contract NAS9-17145; N00014-85-K-0152; NSF DCR-83-18514)

A review is presented of efforts currently in progress at the NASA/Johnson Space Center and Rice University, the accomplishments to date, and some of the anticipated future developments. Both systems and algorithms are discussed. The evolution of future vision/sensing is projected to include the fusion of multisensors ranging from microwave to optical with multimode capability to include position, attitude, recognition, and motion parameters. The algorithms for information extraction are expected to incorporate aspects of intelligence and knowledge for the interpolation and extrapolation of the needed data. The key features of the overall system design will be small size and weight, fast signal processing, robust algorithms, and accurate parameter determination. These aspects of vision/sensing are also discussed. I.E.

**A88-42657\*** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

## SENSING AND PERCEPTION RESEARCH FOR SPACE TELEROBOTICS AT JPL

DONALD B. GENNERY, TODD LITWIN, BRIAN WILCOX, and BRUCE BON (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1987 IEEE International Conference on Robotics and Automation, Raleigh, NC, Mar. 31-Apr. 3, 1987, Proceedings. Volume 1. Washington, DC, IEEE Computer Society Press, 1987, p. 311-317. refs

PIFLEX is a pipelined-image processor that can perform elaborate computations whose exact nature is not fixed in the hardware, and that can handle multiple images. A wire-wrapped prototype PIFEX module has been produced and debugged, using a version of the convolver composed of three custom VLSI chips (plus the line buffers). A printed circuit layout is being designed for use with a single-chip convolver, leading to production of a PIFEX with about 120 modules. A high-level language for programming PIFEX has been designed, and a compiler will be written for it. The camera calibration software has been completed and tested. Two more terms in the camera model, for lens distortion, probably will be added later. The acquisition and tracking system has been designed and most of it has been coded in Pascal for the MicroVAX-II. The feature tracker, motion stereo module and stereo matcher have executed successfully. The model matcher is still under development, and coding has begun on the

tracking initializer. The object tracker was running on a different computer from the VAX, and preliminary runs on real images have been performed there. Once all modules are working, optimization and integration will begin. Finally, when a sufficiently large PIFEX is available, appropriate parts of acquisition and tracking, including much of the feature tracker, will be programmed into PIFEX, thus increasing the speed and robustness of the system. I.E.

**A88-42658\*** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**UNIVERSAL COMPUTER CONTROL SYSTEM (UCCS) FOR SPACE TELEROBOTS**

ANTAL K. BEJCZY and ZOLTAN SZAKALY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1987 IEEE International Conference on Robotics and Automation, Raleigh, NC, Mar. 31-Apr. 3, 1987, Proceedings. Volume 1. Washington, DC, IEEE Computer Society Press, 1987, p. 318-324.

A universal computer control system (UCCS) is under development for all motor elements of a space telerobot. The basic hardware architecture and software design of UCCS are described, together with the rich motor sensing, control, and self-test capabilities of this all-computerized motor control system. UCCS is integrated into a multibus computer environment with direct interface to higher level control processors, uses pulsewidth multiplier power amplifiers, and one unit can control up to sixteen different motors simultaneously at a high I/O rate. UCCS performance capabilities are illustrated by a few data. I.E.

**A88-42667**

**THE SPACE AND TELEROBOTIC CONCEPTS OF DFVLR ROTEX**

G. HIRZINGER (DFVLR, Institut fuer Dynamik der Flugsysteme, Weßling, Federal Republic of Germany) IN: 1987 IEEE International Conference on Robotics and Automation, Raleigh, NC, Mar. 31-Apr. 3, 1987, Proceedings. Volume 1. Washington, DC, IEEE Computer Society Press, 1987, p. 443-449. refs

Concepts are outlined for a robot technology experiment ROTEX the author has proposed to fly with the next Germany spacelab, mission D2 (originally planned for 1988, but delayed for at least two years). It provides a small, six-axis robot inside a space-lab rack, equipped with a multisensory gripper (force/torque, an array of range finders, stereo optical fibers). The robot is supposed to handle a biological experiment, to perform several assembly and servicing tasks, and to grasp floating objects. The authors focus on the man-machine and supervisory control concepts for teleoperation from the spacecraft and from ground and especially explains the predictive estimation schemes for an extensive use of delay-compensating three-dimensional computer graphics. I.E.

**A88-42668\*#** Oak Ridge National Lab., Tenn.

**TRACTION-DRIVE TELEROBOT FOR SPACE MANIPULATION**

J. N. HERNDON, W. R. HAMEL, and D. P. KUBAN (Oak Ridge National Laboratory, TN) IN: 1987 IEEE International Conference on Robotics and Automation, Raleigh, NC, Mar. 31-Apr. 3, 1987, Proceedings. Volume 1. Washington, DC, IEEE Computer Society Press, 1987, p. 450-455. NASA-supported research. Previously announced in STAR as N87-22233. refs (Contract DE-AC05-84OR-21400)

The National Aeronautics and Space Administration (NASA) Space Station Program marks the beginning of a new era in space utilization and habitation. Extensive use of remote manipulation and robotics to reduce astronaut extra-vehicular activity is expected. Emphasis on teleoperator technology in early Space Station phases, followed by growth of autonomous robotics capabilities, is planned. A new telerobot concept has been developed at Oak Ridge National Laboratory (ORNL) under NASA Langley Research Center sponsorship, to address the technical needs of both teleoperations and telerobotics for these future NASA programs. The concept is based on traction drives, redundant kinematics, modular construction, and a state-of-the-art distributed, hierarchical control system. Author

**A88-42677\*** Massachusetts Inst. of Tech., Cambridge.

**ON THE DYNAMICS OF MANIPULATORS IN SPACE USING THE VIRTUAL MANIPULATOR APPROACH**

Z. VAFA and S. DUBOWSKY (MIT, Cambridge, MA) IN: 1987 IEEE International Conference on Robotics and Automation, Raleigh, NC, Mar. 31-Apr. 3, 1987, Proceedings. Volume 1. Washington, DC, IEEE Computer Society Press, 1987, p. 579-585. refs (Contract NAG1-489)

A virtual manipulator (VM) concept has been developed recently for the modeling of manipulators working in space. The authors show that the VM facilitates planning and control of the motions of manipulators mounted on spacecraft, minimizing the degrading consequences of manipulator/vehicle dynamic interactions. I.E.

**A88-42678\*** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**HAND TRIGGER SYSTEM FOR BI-LATERAL GRIPPING CONTROL IN TELEOPERATION**

PAOLO FIORINI, BLAKE HANNAFORD, BRUNO JAU, EDWIN KAN, and ANTAL BEJCZY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: 1987 IEEE International Conference on Robotics and Automation, Raleigh, NC, Mar. 31-Apr. 3, 1987, Proceedings. Volume 1. Washington, DC, IEEE Computer Society Press, 1987, p. 586-592. refs

A device for human operator control of a robotic gripper has been developed and preliminary evaluation has been performed. The JPL Force Reflecting Hand Trigger system features an instrumented index finger trigger with load cell detection of finger force, a servo-controlled, lead-screw-driven backdrive capability by which the trigger's position can be made to follow that of the remotely controlled gripper, and a novel feedback mechanism by which clamping force or some other signal can be fed back by a swiveling motion, also servo-controlled, of the trigger surface (force reflection). This system has undergone preliminary testing in which the amount of force reflection is varied and dynamic force-tracking response is observed. I.E.

**A88-42743**

**COORDINATED CONTROL OF MULTI-AXIS TASKS**

G. MURDOCH MCKINNON, MICHAEL L. KING, and DAVID W. RUNNINGS (CAE Electronics, Ltd., Montreal, Canada) IN: 1987 IEEE International Conference on Robotics and Automation, Raleigh, NC, Mar. 31-Apr. 3, 1987, Proceedings. Volume 3. Washington, DC, IEEE Computer Society Press, 1987, p. 1767-1770.

A description is given of tests carried out to evaluate three man-machine interfaces with two dextrous manipulators. The three interfaces were a master/slave system with force reflection, a master/slave system without force reflection, and two six-degree-of-freedom handcontrollers. Results indicated that task accuracy was superior with the handcontrollers. The time taken to complete the tasks with the handcontroller was longer than with the master/slave system with force reflection but with force reflection removed, no differences were found. I.E.

**A88-42928#**

**SUMMARY OF THE WORKSHOP ON COCKPIT AUTOMATION IN COMMERCIAL AIRPLANES**

ROLF BRAUNE (Boeing Commercial Airplane Co., Seattle, WA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 9-15. refs

This paper discusses problems existing in cockpit automation technology applications in commercial aircraft. Among general issues examined are the correct implementation of automation, adequate communication between users and manufacturers, the necessity of taking a consideration of the pilot's experience and training in design of a particular automated system, adequate training programs for advanced-technology aircraft, and better coordination between academic research and practical application. In the category of technical, system-specific issues and underlying problem causes, special consideration is given to the questions of



system malfunctions and crew alerting, the issues related to displays and symbology, the computer override capability of the fly-by-wire systems, and specific problems involved in the long-haul and short-haul operations. I.S.

**A88-42929#**  
**SHAPE AND OBJECT DISPLAYS FOR SECONDARY SYSTEM MONITORING**

DENNIS B. BERINGER and STEVEN E. CHRISMAN (New Mexico State University, Las Cruces) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 16-22. refs

This paper examines the effects of four information display formats, constructed using the same number of indicators, on the momentary flight control, as judged by the performance of twelve right-handed operators in a differentiation task, which required the subject to monitor four indices (at the north, south, east, and west positions), regardless of the number of same. The formats considered included a polar histogram, segmented polar polygon open polar polygon, a conventional display using univariate needle indicators. Performance with the polar histogram display was found to be superior in all cases, due to the alerting cues provided by the histogram. The performance when using polar polygon formats was found to be less effective than with polar histogram, but superior to performance when using multiple univariate needle indicators. I.S.

**A88-42930#**  
**SWITCHING AND AUTOMATION TRADEOFFS IN THE NEXT GENERATION AIR-SUPERIORITY FIGHTER**

GREGORY J. BARBATO and STEPHEN D. DETRO (Midwest Systems Research, Inc., Dayton, OH) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 23-29. refs

The Tactical Aircraft Cockpit Study program established for the support of the USAF's procurement of an advanced tactical fighter is described. The program is structured in two phases, the preliminary design phase (Phase 1) and the dynamic cockpit studies (Phase 2). During Phase 1, design scenarios were constructed and used in an evaluation of an advanced fighter cockpit in which pilot workload was subjectively assessed by 12 tactically experienced USAF pilots. Issues evaluated included three proposed control modes (voice, touch screen, and hands-on-throttle-and-stick) and the use of chemical-biological-radiological (CBR) protection gear. The results of the Phase 1 study indicated that the improvements in cockpit automation, displays, controls, and avionics moding are not equally powerful in reducing pilot workload under all mission segments and conditions. Phase 2 studies, scheduled to begin in May, 1987, involve the issues of dynamic refinements for the cockpit, such as operational switches, changeable display formats, and operable throttle and stick with corresponding HUD technology. I.S.

**A88-42931#**  
**EVALUATING THE PANORAMIC COCKPIT CONTROLS AND DISPLAYS SYSTEM**

CHRISTOPHER J. ARBAK (McDonnell Douglas Astronautics Co., Saint Louis, MO), NOEL SCHWARTZ (USAF, Wright-Aeronautical Laboratories, Wright-Patterson AFB, OH), and GIL KUPERMAN (USAF, Harry G. Armstrong Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 30-36. refs

This paper describes the Panoramic Cockpit Controls and Displays System (PCCADS) designed for the correlation and display of the information received from multiple sources on a single display. Special consideration is given to the PCCADS cockpit description and the evaluation of the system's capabilities. To evaluate the key factors which will determine the success of the crew station design (i.e., situation awareness, workload, and

performance) on a simulator cockpit, each of these factors must be considered separately. The performance measures selected for each of these three factors are discussed. I.S.

**A88-42932#**  
**MULTI-FUNCTION DISPLAYS IN THE COCKPIT - A METHODOLOGY FOR INTERFACE AND INTERACTION DESIGN**

AVRAHAM PARUSH (Israel Aircraft Industries, Ltd., Human Factors Engineering Dept., Lod) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 37-43. refs

The basic principles involved in the interface and interaction methodology for the cockpit multifunction displays (MFDs) is discussed, with particular attention given to the MFDs which include only software-controlled keys. The proposed methodology presents a systematic process of identifying and mapping the correspondence between MFD functions and their spatial/visual labeling. Special consideration is given to the unique constraints and problems involved in the display format issues and interaction with various types of MFD's (i.e., the multidimensionality of MFD labels), the psychological aspects of the MFD problem, and the steps involved in the interface and interaction methodology. I.S.

**A88-42934#**  
**THE PERIPHERAL VISION HORIZON DISPLAY - A REVIEW**

DONALD HAMELUCK and PAUL STAGER (York University, Toronto, Canada) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 51-57. Sponsorship: Department of Supply and Services. refs (Contract DSS-01SE-W7711-6-9116)

The theoretical basis of the peripheral vision horizon displays (PVHDs), which attempt to provide the pilot with useful orientation information without the requirement to look directly at the information source, are discussed. Attention is given to the dynamic information provided by the PVHDs, the effect of information context, attention allocation, and the display-control compatibility. As a result of this evaluation, it is suggested that the concept of the PVHD merits a carefully controlled evaluation, since an effective PVHD device would reduce the need to continually check the AI during instrument flight and would lessen the possibility of a development of spatial disorientation due to a loss of attitude of awareness. I.S.

**A88-42936#**  
**A STUDY OF INFORMATION TRANSFER PERFORMANCE OF PICTORIALS VS TEXT**

JOHN P. ZENYUH, DAVID G. CURRY, JAMES E. MCCLAIN, and JOHN M. REISING (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 65-69. refs

The effectiveness of pictorial and textual dot matrix symbologies designed for fighter-aircraft displays was compared using a generic mockup of a fighter cockpit in which programmable switches were installed. In the first part of the study (the single-symbol case), the ability of subjects to recognize a single symbol (pictorial vs textual) when presented for a period of 50 msec was analyzed; the second series of tests examined the ability to locate a particular target symbol within a group of four symbols flashed simultaneously for 200 msec (the four-switch case). Objective data were analyzed using the multivariate-analysis-of-variance subprogram of the SPSS package described by Hull and Nie (1981). The results showed that, in the case of single symbol, textual symbols were more easily recognized than pictorials. In the four-switch case, this superiority effect no longer existed. I.S.

**A88-42937#**  
**ATTITUDE AWARENESS FROM AIRCRAFT HEAD-UP DISPLAYS**

ROBERT M. TAYLOR (RAF, Institute of Aviation Medicine,

Farnborough, England) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 70-76. refs

This paper is concerned with attitude awareness derived from aircraft instruments, in particular the comprehension of pitch, roll, and horizon information from head-up displays. Human visual orientation is discussed with respect to dual-mode theory of focal and ambient visual information processing, with particular emphasis on the perception of pattern orientation and the relative contributions of global and local features in multidimensional structures. It is argued that global organizational characteristics of display formats are important and neglected sources of cues for attitude awareness. An improved pitch scale symbology for head-up displays is proposed based on empirical evidence from studies of operator performance on unusual attitude recovery tasks. Author

## A88-42939#

### THE APPLICATION OF VOICE TECHNOLOGY IN SPACE VEHICLES

HARVEY WICHMAN (Claremont McKenna College, CA) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 84-90.

Issues related to the use of voice technology on the forthcoming Space Station and other space vehicles are examined. Consideration is given to the principles involved in the design of two types of voice-input equipment (stand-alone and add-on units) and of two types of voice output units (synthesized and digitized), and to the operation of the voice input and output (I/O) systems. The present state-of-the-art of voice technology is examined on the example of the voice I/O equipment used in the AFTI F-16 cockpit. Applications of voice I/O in the Space Station intravehicular activity and in EVA are discussed, and recommendations for the Space Station are offered. I.S.

## A88-42940#

### COMPARISON OF ALPHANUMERIC DATA ENTRY METHODS FOR ADVANCED HELICOPTER COCKPITS

FRANK J. MALKIN and KATHLEEN A. CHRIST (U.S. Army, Human Engineering Laboratory, Aberdeen Proving Ground, MD) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 91-100. refs

In this study, three methods of data entry were compared for entering navigation coordinate sets: (1) connected-word voice recognition, (2) keyboard, and (3) thumb-controlled force stick. The subjects, 12 active U.S. Army aviators, entered the data as a sole task and also while flying a helicopter simulator equipped with a computer-generated external scene. The different data entry methods were compared for time to enter the data, errors, and effect on flight performance. Results showed that the keyboard was faster and resulted in fewer errors than the other two data entry methods. The time to enter data by voice was increased by the high nonrecognition rate (12 percent) and the error correction procedures. An overall 81-percent recognition accuracy rate was achieved in this study, with individual rates varying from 58 to 99 percent. Based on a subjective questionnaire, the majority of subjects still preferred to enter data by voice. Author

## A88-42941#

### PILOT PERFORMANCE ENHANCEMENTS THROUGH VOICE APPLICATIONS IN THE AFTI/F-16 AIRCRAFT

J. STEVEN ECKEL, FRANK A. GORG, STEVEN W. RABELER, and F. ALLAN ROSENHOOVER (General Dynamics Corp., Fort Worth, TX) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 101-107.

This paper describes a voice command system termed Voice Interactive Avionics (VIA) and presents preliminary results from recent AFTI/F-16 flight testing of the system. The test program included two tests: (1) a low-level navigation task consisting of a fixed-route over moderate terrain at 480 knots and 500 feet above ground level and (2) an air-to-air tracking task in which the pilot

was to maintain exactly 1500 ft range to the target aircraft while tracking its engine's nozzle in a 3-g, 450-knot, 15,000 ft above mean sea level environment. Subjective and objective performance data collected indicate that voice command resulted in an overall improvement in pilot's performance under high workload conditions, such as low-level navigation and air-to-air tracking. I.S.

## A88-42948#

### NEUROPSYCHOLOGY IN THE COCKPIT - AN ANALYSIS OF CONFIGURATIONAL PROCESSING, HEMISPHERIC ASYMMETRY, AND MASKING DISTURBANCE

MICHAEL D. MCNEESE (USAF, Harry G. Armstrong Aerospace Medical Research Laboratories, Wright-Patterson AFB, OH) and RONALD M. KATSUYAMA (Dayton, University, OH) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 202-208. refs

The influence of the type of stimulus and allotted processing time on the type of cognitive processing in the left and the right hemispheres was investigated. Specifically, the nature of such differences was examined using a masking disturbance condition (by a gray or a letter mask) introduced after a stimulus was tachistoscopically presented to a given hemisphere. Half of the images were presented in the inverted orientation. It was found that upright images were better recognized than inverted ones, and that upright images followed by a gray mask were better recognized than those followed by a letter mask, while the recognition of inverted images was not influenced by the type of mask. Implications of these findings are drawn in terms of constructing a cerebral interface that takes advantage of the hemispheric encoding of information, the location of that information in a visual field, and allowable processing time for the different kinds of information. I.S.

## A88-42990\*#

### ILLINOIS UNIV., SAVOY. AUTOMATION - CHANGES IN COGNITIVE DEMANDS AND MENTAL WORKLOAD

PAMELA S. TSANG (Illinois, University, Savoy) and WALTER W. JOHNSON (National Research Council, Washington, DC) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 616-622. refs (Contract NAG2-308)

The effect of partial automation on mental workloads in man/machine tasks is investigated experimentally. Subjective workload measures are obtained from six subjects after performance of a task battery comprising two manual (flight-path control, FC, and target acquisition, TA) tasks and one decisionmaking (engine failure, EF) task; the FC task was performed in both a fully manual (altitude and lateral control) mode and in a semiautomated mode (automatic latitude control). The performance results and subjective evaluations are presented in graphs and characterized in detail. The automation is shown to improve objective performance and lower subjective workload significantly in the combined FC/TA task, but not in the FC task alone or in the FC/EF task. T.K.

## A88-42997#

### THE EFFECTS OF CONTROL SYSTEM NONLINEARITIES ON TRACKING PERFORMANCE - SPECULATIONS AND HYPOTHESES

JOHN W. SENDERS (Maine, University, Orono) IN: International Symposium on Aviation Psychology, 4th, Columbus, OH, Apr. 27-30, 1987, Proceedings. Columbus, OH, Ohio State University, 1987, p. 678-682. refs (Contract DAAA15-86-K-0012)

An analysis of the potential effects of certain intangible nonlinearities in closed loop systems reveals that such systems will be perceived by human operators as linear and the compensations introduced by the the human operator will be inappropriate to the nonlinearity. However, if the nonlinearity is tangible, the compensation can be appropriate and a resulting resistance to degradation in performance will be observed. K.K.

**A88-43954#****CLOSED ECOLOGICAL SYSTEMS TRANSPLANTING EARTH'S BIOSPHERE TO SPACE**

CLAIR E. FOLSOME (Hawaii, University, Honolulu) IN: Space manufacturing 6 - Nonterrestrial resources, biosciences, and space engineering; Proceedings of the Eighth Princeton/AIAA/SSI Conference, Princeton, NJ, May 6-9, 1987. Washington, DC, American Institute of Aeronautics and Astronautics, 1987, p. 71-75. refs

Recyclable or regenerative life support systems must be devised to allow indefinitely extended manned missions in space, balancing all crew inputs and outputs and closing cyclic circles for all biological and nonbiological matter. All food, water, and oxygen required would in these systems be reprocessed from metabolic wastes at the microbial and/or chemical level. It is presently shown on the basis of extensive experimental evidence that the foundation for stable closed ecologies of all types is microbial; microbes can be solely responsible for the closing of the bioelemental cycles of all known and foreseeable ecologies. O.C.

**A88-43955#****AN INTRODUCTION TO THE INTENSIVE AGRICULTURE BIOME OF BIOSPHERE II**

LINDA LEIGH (Space Biospheres Ventures, Oracle, AZ) and KEVIN FITZSIMMONS (Arizona, University, Tucson) IN: Space manufacturing 6 - Nonterrestrial resources, biosciences, and space engineering; Proceedings of the Eighth Princeton/AIAA/SSI Conference, Princeton, NJ, May 6-9, 1987. Washington, DC, American Institute of Aeronautics and Astronautics, 1987, p. 76-81. refs

Biosphere II is a one-hectare, materially-closed, energetically and informationally open ecological system of seven biomes (tropical rainforest, savannah, marine, marsh, desert, intensive agriculture and human habitat) being designed as a scientific and management tool for ecological research applicable to the biosphere of the earth and regenerative life habitats in space or on the moon or Mars. This paper discusses the Intensive Agriculture Biome, which has an area of 2069 sq m and a volume of 35,456 cu m. System design is based upon local environmental conditions in Oracle, Arizona, and a cropping scheme to provide recommended dietary allowances for eight adults over a two-year initial closure period has been developed. Water and nutrient recycling, soil mix and development, integrated pest management, and use of expert systems and computer models are discussed. Author

**A88-43956#****ENERGETICS OF CLOSED BIOLOGICAL LIFE SUPPORT SYSTEMS**

S. C. DOLL and R. A. FAZZOLARI (Arizona, University, Tucson) IN: Space manufacturing 6 - Nonterrestrial resources, biosciences, and space engineering; Proceedings of the Eighth Princeton/AIAA/SSI Conference, Princeton, NJ, May 6-9, 1987. Washington, DC, American Institute of Aeronautics and Astronautics, 1987, p. 82-89. refs

Energy requirements for the biological components (specifically the plants) of a biologically based life support system in a spatial environment such as the moon or Mars are quantified. Particular focus is placed on the biological components with regard to establishing the energy needed to sustain them. For plants the primary demand is from transpiration and photosynthesis, though other related energy and work requirements are mentioned. It is found that the energy required for transpiration and photosynthesis are of the same magnitude. However, the combined demand is not the sum of the two. Although not examined in detail, other biological processes such as bacterial degradation for waste recycle and air contaminant control are included. Author

**A88-43957#****AN ELECTROCATALYTIC WASTE PROCESSING SYSTEM FOR CLOSED ENVIRONMENTS**

PATRICK M. DHOOGHE (Delphi Research, Inc., Albuquerque, NM) IN: Space manufacturing 6 - Nonterrestrial resources, biosciences, and space engineering; Proceedings of the Eighth

Princeton/AIAA/SSI Conference, Princeton, NJ, May 6-9, 1987. Washington, DC, American Institute of Aeronautics and Astronautics, 1987, p. 90-97. refs

A system and process is described which oxidizes organic waste materials in aqueous media at 100-150 C utilizing an EC electrochemical catalytic reaction. The oxidation rate of the organic compounds is further increased by the use of a homogeneous cocatalyst. The product of the organic oxidation is principally CO<sub>2</sub> with small amounts of impurities whose levels are dependent on the nature of the waste material. The electrocatalyst solution is regenerated by the anode of an electrochemical cell, wherein hydrogen is produced at the cell cathode. The hydrogen can be burned in a fuel cell to produce water and sufficient power to operate the electrocatalytic cells, or it may be utilized as a propulsion fuel element. Results of experiments with various model compounds, wood chips, cattle manure, and sewage sludge, will be presented, including analysis of gaseous products, solution and solid residues, reaction rate constants and activation energies. A nominal fifty-person waste processing unit now being constructed at Delphi Research, Inc., will be shown and the plan for its testing and evaluation described. Author

**A88-43962#****USE OF A 2-METER RADIUS CENTRIFUGE ON SPACE STATION FOR HUMAN PHYSIOLOGIC CONDITIONING AND TESTING**

PETER H. DIAMANDIS (MIT; Harvard University, Cambridge, MA) IN: Space manufacturing 6 - Nonterrestrial resources, biosciences, and space engineering; Proceedings of the Eighth Princeton/AIAA/SSI Conference, Princeton, NJ, May 6-9, 1987. Washington, DC, American Institute of Aeronautics and Astronautics, 1987, p. 133-136.

NASA Space Station life sciences experiments are planned to employ two centrifuges of 0.9 and 2.0 m radii; of these, the larger would be used to keep the crew in good health during long duration missions, counteracting the physiologic deconditioning that occurs in extended exposure to microgravity by exerting artificial gravity during sleep. Such exercises as deep knee bends could also be conducted on the 2.0-m centrifuge. The crewmember will be disposed on the centrifuge with head at center and feet at the radially most outward point. O.C.

**A88-45195****SIMULATION AND ANALYSIS OF A BIODYNAMIC HUMAN MODEL SUBJECTED TO LOW ACCELERATIONS - A CORRELATION STUDY**

F. M. L. AMIROUCHE and S. K. IDER (Illinois, University, Chicago) Journal of Sound and Vibration (ISSN 0022-460X), vol. 123, June 8, 1988, p. 281-292. refs

A simulation of responses of a biodynamic human model subjected to pure sinusoidal vertical vibrations is presented. The procedures used in the analysis are based on a computer automated approach developed by Amirouche (1984) for the study of multibody system dynamics. A three-dimensional computer program, called the human body vibration analysis, was developed and its corresponding algorithm is presented. The motion of the upper part of the human model is investigated in the sagittal plane for axial and rotary accelerations, including correlation studies with previous experimental findings. The root-mean-square values were used to determine the transfer functions for each segment of the upper body of the model in the frequency domain. Based upon the present results, the biodynamic model used in the analysis is found to be exceptionally useful in determining the responses of each segment, and the magnitudes of the linear joint forces when the human body is subjected to low accelerations. Author

**A88-45351****ANTI-G SUIT INFLATION RATE REQUIREMENTS**

R. R. BURTON (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, July 1988, p. 601-605. refs

Relaxed +Gz rapid-onset tolerances were measured on the human-use centrifuge at the USAF School of Aerospace Medicine,

using male research subjects with and without inflated anti-G suits. Tolerance at 6 G/s onset rates were 0.2-0.3 G lower than those measured with 1 G/s onset rates, thus suggesting the existence of another relaxed G tolerance measurement called very high onset G. Baroreceptor effect was considered the reason for this difference. Delays of a mean of 3.3 s in inflating the anti-G suit did not change relaxed G tolerances at 6 G/s onset rates; however, with a 4.2-s mean delay, light-loss tolerance criteria occurred sooner during the G exposure. Tolerances to 7 G with 6 G/s onset rates, during which the subjects had to perform the anti-G straining maneuver (AGSM), required a mean delay of 2.8 s in six subjects before a noticeable change in light-loss criteria occurred - a mean delay of 2.0 s resulted in no change in light-loss criteria from zero delay control inflation rates. These results clearly indicate that the inflation of the anti-G suit can be delayed by at least 1 s without compromising anti-G suit protection. Author

A88-45628

# **SIMPLIFIED INTEGRATED TEST OF A BREADBOARD REGENERATIVE ECLSS**

J. GREG MCALLISTER (Martin Marietta Corp., Denver, CO) SAE, Intersociety Conference on Environmental Systems, 17th, Seattle, WA, July 13-15, 1987. 10 p.  
(SAE PAPER 871455)

NASA-Marshall has undertaken a program of technology evaluation and feasibility testing for the system and subsystem hardware of a regenerative ECLSS. The breadboard ECLSS simulator developed for this task encompasses facility instrumentation and data acquisition systems, subsystem control electronics, a Sabatier reactor, a thermoelectric integrated membrane evaporator, a solid-amine water desorber, and a solid polymer electrolyte water electrolysis system. O.C.

N88-24131# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

# **LIFE SUPPORT SUBSYSTEM (LSS). CONCEPT FOR THE BOTANY FACILITY**

H. LOESER *In its* Botany Facility Pre-Phase C/D Core Payload for EURECA, Volume 2 21 p 18 Nov. 1986  
(TN-RB524-107/86) Avail: NTIS HC A17/MF A01

The design concept of the LSS for the EURECA Botany Facility is described on a functional basis, with a view to systems design drawings and the required inputs for data handling. The LSS is subdivided into 3 modules: the Atmosphere Storage And Composition Control module, the Ventilation And Dryer module, and the Soil, Agar And Seed module. The requirements and concept description of each module are given. ESA

N88-24132# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

# **IMPACT OF CONTROL ERRORS ON THE VOLUME/WEIGHT DEMAND OF THE VENTILATION AND DRYER (VAD) CONCEPT**

H. LOESER and W. P. FOTH *In its* Botany Facility Pre-Phase C/D Core Payload for EURECA, Volume 2 28 p 18 Nov. 1986  
(TN-RB524-006/87) Avail: NTIS HC A17/MF A01

The soil volume and the water weight required for the VAD-concept based on water reclamation and the VAD-concept centralized water condensation/collection were computed in order to provide inputs for a preliminary component accommodation. After a comparison of the results, the VAD-module based on centralized water condensation/collection, the soil, agar, and seed module is proposed as baseline solution as the best compromise between technical maturity and weight and volume penalties. ESA

N88-24133# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

# **SUMMARY OF THE ACTIVITIES PERFORMED DURING THE BOTANY FACILITY (BF) PREDEVELOPMENT PHASE FOR THE LIFE SUPPORT S/S (LSS)**

H. LOESER *In its* Botany Facility Pre-Phase C/D Core Payload

for EURECA, Volume 2 89 p 18 Nov. 1986

(TB-RB524-002/87) Avail: NTIS HC A17/MF A01

The results obtained in the predevelopment phase in the different work packages for the LSS are summarized in order to facilitate for the customer comparison between the tasks. The tasks performed and the results obtained in the following work packages are summarized: solution of design problems related to botanical requirements; subsystem design; laboratory model design; model manufacturing; test and verification; design, manufacturing and test of the Atmosphere Storage And Composition Control module for the model; and experiment concept of model payload. ESA

N88-24143# Sira Inst. Ltd., Chislehurst (England).

# **EURECA BOTANY FACILITY. TECHNICAL NOTE: REMOVAL OF PHYTOTOXINS**

*In* MBB GmbH, Botany Facility Pre-Phase C/D Core Payload for EURECA, Volume 2 2 p 18 Nov. 1986

(SIRA-A/7373/WP220/RJS/005) Avail: NTIS HC A17/MF A01

Two methods for the removal of phytotoxins from the atmosphere of the Botany Facility are considered. The only substance produced by plants that is likely to affect them is ethylene. The chemical removal of ethylene requires a reaction in which neither the reagent nor the products are phytotoxic, and which is capable of removing ethylene down to low levels. The most suitable reaction is found to be that with potassium permanganate supported on silica gel. The chemical is simple, but suffers from the resistance to the air flow introduced, thereby increasing the required for power, and from its finite capacity for ethylene removal. The catalytic removal of ethylene by oxidation to carbon dioxide and water has an infinite removal capacity, but requires power and represents an additional thermal load. The catalytic method is preferred. ESA

N88-24147# McDonnell-Douglas Astronautics Co., Houston, Tex.

# **ADVANCED EVA SYSTEM DESIGN REQUIREMENTS STUDY**

T. G. WOODS *In* NASA, Ames Research Center, Space Station Human Factors Research Review. Volume 1: EVA Research and Development p 85-130 Apr. 1988

Avail: NTIS HC A07/MF A01 CSCL 05H

The results are presented of a study to identify specific criteria regarding space station extravehicular activity system (EVAS) hardware requirements. Key EVA design issues include maintainability, technology readiness, LSS volume vs. EVA time available, suit pressure/cabin pressure relationship and productivity effects, crew autonomy, integration of EVA as a program resource, and standardization of task interfaces. A variety of DOD EVA systems issues were taken into consideration. Recommendations include: (1) crew limitations, not hardware limitations; (2) capability to perform all of 15 generic missions; (3) 90 days on-orbit maintainability with 50 percent duty cycle as minimum; and (4) use by payload sponsors of JSC document 10615A plus a Generic Tool Kit and Specialized Tool Kit description. EVA baseline design requirements and criteria, including requirements of various subsystems, are outlined. Space station/EVA system interface requirements and EVA accommodations are discussed in the areas of atmosphere composition and pressure, communications, data management, logistics, safe haven, SS exterior and interior requirements, and SS airlock. J.P.B.

N88-24150# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

# **IMAGE MANAGEMENT RESEARCH**

ANDREW B. WATSON *In its* Space Station Human Factors Research Review. Volume 4: Inhouse Advanced Development and Research p 23-28 May 1988

Avail: NTIS HC A07/MF A01 CSCL 05H

Two types of research issues are involved in image management systems with space station applications: image processing research and image perception research. The image processing issues are the traditional ones of digitizing, coding, compressing, storing, analyzing, and displaying, but with a new emphasis on the

constraints imposed by the human perceiver. Two image coding algorithms have been developed that may increase the efficiency of image management systems (IMS). Image perception research involves a study of the theoretical and practical aspects of visual perception of electronically displayed images. Issues include how rapidly a user can search through a library of images, how to make this search more efficient, and how to present images in terms of resolution and split screens. Other issues include optimal interface to an IMS and how to code images in a way that is optimal for the human perceiver. A test-bed within which such issues can be addressed has been designed. J.P.B.

**N88-24151\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**NASA-AMES WORKLOAD RESEARCH PROGRAM**

SANDRA HART *In its* Space Station Human Factors Research Review. Volume 4: Inhouse Advanced Development and Research p 29-76 May 1988

Avail: NTIS HC A07/MF A01 CSCL 05H

Research has been underway for several years to develop valid and reliable measures and predictors of workload as a function of operator state, task requirements, and system resources. Although the initial focus of this research was on aeronautics, the underlying principles and methodologies are equally applicable to space, and provide a set of tools that NASA and its contractors can use to evaluate design alternatives from the perspective of the astronauts. Objectives and approach of the research program are described, as well as the resources used in conducting research and the conceptual framework around which the program evolved. Next, standardized tasks are described, in addition to predictive models and assessment techniques and their application to the space program. Finally, some of the operational applications of these tasks and measures are reviewed. Author

**N88-24153\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**VIRTUAL INTERFACE ENVIRONMENT**

SCOTT S. FISHER *In its* Space Station Human Factors Research Review. Volume 4: Inhouse Advanced Development and Research p 85-87 May 1988 Previously announced in IAA as A87-31494

Avail: NTIS HC A07/MF A01 CSCL 05H

A head-mounted, wide-angle, stereoscopic display system controlled by operator position, voice and gesture is under development for use as a multipurpose interface environment. Initial applications of the system are in telerobotics, data-management and human factors research. System configuration and research directions are described. Author

**N88-24162\*#** Martin Marietta Aerospace, Denver, Colo. **TELEOPERATOR HUMAN FACTORS STUDY Final Report** May 1986 68 p

(Contract NAS8-35184)

(NASA-CR-178930; NAS 1.26:178930; MCR-86-542) Avail: NTIS HC A04/MF A01 CSCL 05H

An investigation of the spectrum of space teleoperation activities likely in the 1985 to 1995 decade focused on the resolution of critical human engineering issues and characterization of the technology effect on performance of remote human operators. The study began with the identification and documentation of a set of representative reference teleoperator tasks. For each task, technology, development, and design options, issues, and alternatives that bear on human operator performance were defined and categorized. A literature survey identified existing studies of man/machine issues. For each teleoperations category, an assessment was made of the state of knowledge on a scale from adequate to void. The tests, experiments, and analyses necessary to provide the missing elements of knowledge were then defined. A limited set of tests were actually performed, including operator selection, baseline task definition, control mode study, lighting study, camera study, and preliminary time delay study. J.P.B.

**N88-24163\*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

**RECONFIGURABLE WORK STATION FOR A VIDEO DISPLAY UNIT AND KEYBOARD Patent**

NICHOLAS L. SHIELDS, inventor (to NASA), FRED D. ROE, JR., inventor (to NASA), MARY F. FAGG, inventor (to NASA), and DAVID E. HENDERSON, inventor (to NASA) (Essex Corp., Huntsville, Ala.) 16 Feb. 1988 9 p Filed 5 Dec. 1985 Supersedes N86-22114 (24 - 12, p 1995)

(NASA-CASE-MFS-26009-1-SB; US-PATENT-4,725,106;

US-PATENT-APPL-SN-805011; US-PATENT-CLASS-312-208;

US-PATENT-CLASS-108-3; US-PATENT-CLASS-108-7;

US-PATENT-CLASS-312-7.2; US-PATENT-CLASS-312-196;

US-PATENT-CLASS-312-300) Avail: US Patent and Trademark Office CSCL 05H

A reconfigurable workstation is described having video, keyboard, and hand operated motion controller capabilities. The workstation includes main side panels between which a primary work panel is pivotally carried in a manner in which the primary work panel may be adjusted and set in a negatively declined or positively inclined position for proper forearm support when operating hand controllers. A keyboard table supports a keyboard in such a manner that the keyboard is set in a positively inclined position with respect to the negatively declined work panel. Various adjustable devices are provided for adjusting the relative declinations and inclinations of the work panels, tables, and visual display panels.

Official Gazette of the U.S. Patent and Trademark Office

**N88-25149#** Applications Research Corp., Dayton, Ohio.

**AN ADVANCED PROTOTYPING TOOL FOR HUMAN FACTORS DESIGN Final Report**

THOMAS V. BROWN Mar. 1987 81 p

(Contract DAAA15-86-C-0063)

(AD-A187290; ARC-TR-8782) Avail: NTIS HC A05/MF A01 CSCL 23B

Modern equipment has placed new demands on human factors because of more complex machine/computer functions and increased speed demands. The human operator must interface with mechanical systems, computer software, artificial feedback effects, and other humans. There is a need for a formal, explicitly defined methodology that can be used to model all of these interfaces within one context. This report describes a methodology that satisfies this need. This is a decompositional methodology that is general enough to include all system interactions, including machine effects and psychological characteristics of a human operator. The methodology is also rigorous enough to identify gaps and inadequacies to the user. Its foundation is the USE.IT methodology which was not created under this effort, but the application of which to human factors problems did originate here. An interactive intercom system, a body motion modeling task involving walking and lifting, and a human operator interacting with a radio to keep it tuned are included as examples. GRA

**N88-25150\*#** Purdue Univ., West Lafayette, Ind. Dept. of Psychological Sciences.

**TIMESHARING PERFORMANCE AS AN INDICATOR OF PILOT MENTAL WORKLOAD Final Report**

PATRICIA A. CASPER 31 May 1988 103 p

(Contract NCC2-349)

(NASA-CR-182807; NAS 1.26:182807) Avail: NTIS HC A06/MF A01 CSCL 05H

The research was performed in two simultaneous phases, each intended to identify and manipulate factors related to operator mental workload. The first phase concerned evaluation of attentional deficits (workloads) in a timesharing task. Work in the second phase involved incorporating the results from these and other experiments into an expert system designed to provide workload metric selection advice to nonexperts in the field interested in operator workload. The results of the experiments conducted are summarized. B.G.

**N88-25151#** Army Natick Research and Development Command, Mass.

**THE EFFECTS OF DIFFERENT COMBINATIONS OF INLET AIR CONDITIONS USED FOR COOLING AS MEASURED ON A HEATED MANIKIN Final Report, Dec. 1986 - Jan. 1987**

BARRY DECRISTOFANO and JOSEPH COHEN Oct. 1987 28 p

(AD-A191116; NATICK/TR-88/002) Avail: NTIS HC A03/MF A01 CSCL 05H

The effects of using different inlet air conditions on the cooling performance of the Army's microclimate air vest were studied. A significant difference was found between the use of a 75 F dew point, and either a 60, 65, or 70 F dew point. The interaction between dew point and flow rate was also found to be significant. The testing was done on a sectionalized heated manikin featuring a sweating skin. The results may provide some preliminary guidelines for the development of microclimate cooling equipment. The findings also suggest courses of investigation that future studies should be directed towards. GRA

**N88-25152#** California Univ., Irvine. Dept. of Information and Computer Science.

**A COMPUTATIONAL MODEL OF MOTOR BEHAVIOR Interim Report, Mar. 1986 - Mar. 1987**

WAYNE IBA and PAT LANGLEY Dec. 1987 13 p

(Contract MDA903-85-C-0324; DA PROJ. 2Q1-61102-B-74-F) (AD-A191179; ARI-RN-87-72) Avail: NTIS HC A03/MF A01 CSCL 12I

Generating even simple motor behavior using artificial manipulators has proven to be a very difficult task. A computational model of motor behavior is presented that assumes three inputs: a limb to carry out motor commands, a viewer-centered schema describing the desired behavior, and a sensory-motor interface allowing two-way communication between the agent and the environment. A motor schema is defined as a memory structure containing a few positions from the trace of a movement. The model then produces intervening points between those in the schema. A viewer-centered schema is transformed into its dual representation, facilitating execution of the desired movement on the limb. These two forms of a schema represent the same points in three-dimensional space, but behave in ways which have important differences when they are acted upon by the model. Our model accounts for a number of phenomena from the literature, including the speed/accuracy tradeoff, and the closed and open loop distinction. The model suggests directions for further experimentation. GRA

**N88-25153#** Army Aeromedical Research Lab., Fort Rucker, Ala.

**SIMULTANEOUS MULTIPLE CONTROL FORCE EXERTION CAPABILITIES OF MALES AND FEMALES VERSUS HELICOPTER CONTROL FORCE DESIGN LIMITS**

AARON W. SCHOPPER and GEORGE R. MASTROIANNI Sep. 1987 43 p

(AD-A191653; USAARL-87-14) Avail: NTIS HC A03/MF A01 CSCL 01D

Military standards and design guidelines do not consider the potential for degradation in the magnitude of force which can be applied by a crewmember or operator as the result of having to perform more than one control input at the same time. In assessing helicopter-control referenced strength capabilities as a part of an overall program to update medical standards for US Army flying duty, 130 subjects performed maximal voluntary exertions on each of the three primary helicopter controls (cyclic, collective, and pedals). These exertions were undertaken both as separate inputs to single controls and as simultaneously executed inputs to all three controls. The findings revealed substantial and significant force degradation occurred during simultaneously executed exertions (relative to the magnitudes of single control exertions). Cyclic inputs were affected least. The degree of force degradation associated with collective and pedal inputs varied with the particular combinations of direction-of-exertion employed. The resulting patterns for force degradation were similar for the collective and

pedal with the extent of degradation being larger for the pedal inputs (typically 40-50 percent) than for collective inputs (typically 20-35 percent). Substantial proportions of the subjects (approximately 50 percent of the males and more than 90 percent of the females) were unable to consistently attain design-guide force levels (MIL-H-8501A, 1961) on all three controls during all of the 16 simultaneously executed exertions. GRA

**N88-25154#** Ballistic Research Labs., Aberdeen Proving Ground, Md.

**PERFORMANCE ESTIMATES FOR OPERATIONS CONDUCTED WHILE WEARING INDIVIDUAL PROTECTIVE EQUIPMENT: USER MANUAL Final Report**

CHARLES H. WICK Jan. 1988 57 p

(AD-A191871; BRL-MR-3647) Avail: NTIS HC A04/MF A01 CSCL 05H

The purpose of this publication is to describe the procedures which may be used to determine the individual performance decrement resulting from wearing Individual Protective Equipment (IPE) for exercise and training purposes only. Further, it describes the procedure for using the Force-on-Force algorithm for predicting additional required battalion sized units for exercises simulating combat operations while wearing IPE. Although actual operations are not explicitly described, it is believed that results using the Dbase and procedures of this publication will provide commanders and staff a realistic appreciation of the performance decrement which results from the wearing of IPE. The numerical results should be applied in training and exercise situations. Section 2 is an introduction to the use of the Performance Dbase System. Section 3 is the methodologies which constituted the Dbase, the type of procedures used and the methodology for extracting information from the Dbase. Section 4 introduces the user to the Force-on-Force algorithm and the hypothetical estimations for additional required battalion sized units during simulated combat operations while wearing IPE. GRA

**N88-25155\*#** Maryland Univ., College Park. Biomechanics Lab. **THE EFFICACY OF USING HUMAN MYOELECTRIC SIGNALS TO CONTROL THE LIMBS OF ROBOTS IN SPACE Final Report, 15 Apr. 1987-1988**

JANE E. CLARK and SALLY J. PHILLIPS 20 Jun. 1988 289 p

(Contract NAG5-895) (NASA-CR-182901; NAS 1.26:182901) Avail: NTIS HC A13/MF A01 CSCL 05H

This project was designed to investigate the usefulness of the myoelectric signal as a control in robotics applications. More specifically, the neural patterns associated with human arm and hand actions were studied to determine the efficacy of using these myoelectric signals to control the manipulator arm of a robot. The advantage of this approach to robotic control was the use of well-defined and well-practiced neural patterns already available to the system, as opposed to requiring the human operator to learn new tasks and establish new neural patterns in learning to control a joystick or mechanical coupling device. Author

**N88-25156\*#** McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

**HUMAN PERFORMANCE ISSUES ARISING FROM MANNED SPACE STATION MISSIONS**

WILLIAM K. DOUGLAS Washington NASA Oct. 1986 61 p

(Contract NAS2-11723) (NASA-CR-3942; NAS 1.26:3942; MDC-H1363) Avail: NTIS HC A04/MF A01 CSCL 05H

Ten former NASA astronauts were interviewed using a set of 51 questions developed to encourage the contacts to discuss any thoughts, opinions, conclusions, or suggestions which might have evolved since they left the astronaut program. Strict confidentiality was maintained. At least one astronaut from each of the NASA manned space flight programs, excluding the Space Transportation System (Shuttle), was interviewed. The report records the answers to the questions asked, spontaneous comments, and the investigator's own personal evaluations of the material obtained. No statistical analysis of the material was attempted. The

professional opinions of these ten experienced astronauts will be of value to persons concerned with the design and operation of manned spacecraft and manned space stations. Author

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## SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

**A88-43817**

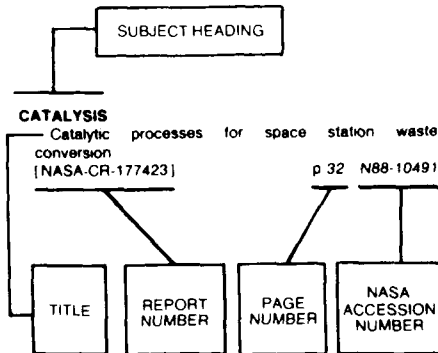
**IMPACT FRUSTRATION OF THE ORIGIN OF LIFE**

KEVIN A. MAHER and DAVID J. STEVENSON (California Institute of Technology, Pasadena) *Nature* (ISSN 0028-0836), vol. 331, Feb. 18, 1988, p. 612-614. refs

One possible definition for the origin of life on earth is the time at which the interval between devastating environmental insults by impact exceeded the timescale for establishing self-replicating protoorganisms. Using a range of plausible values for the timescale for abiogenesis (the development of life through chemical evolution from inorganic materials), the interval in time when life might first have bootstrapped itself into existence can be found for each environment. It is found that if the deep marine hydrothermal setting provided a suitable site, abiogenesis could have happened as early as 4000 to 4200 Myr ago, whereas at the surface of the earth abiogenesis could have occurred between 3700 and 4000 Myr. C.D.



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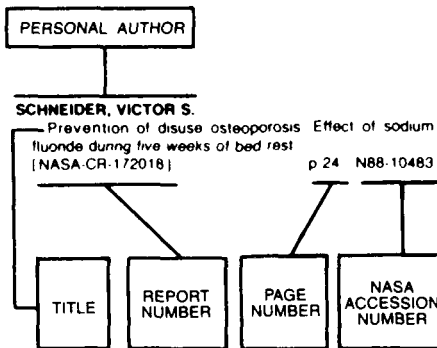
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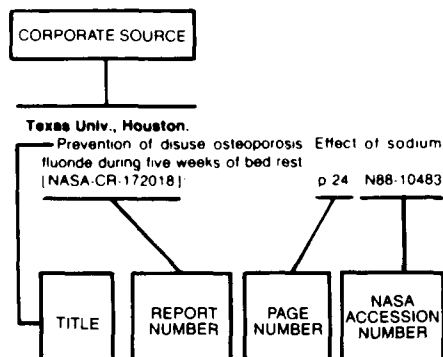
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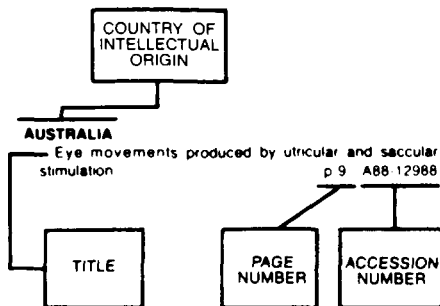
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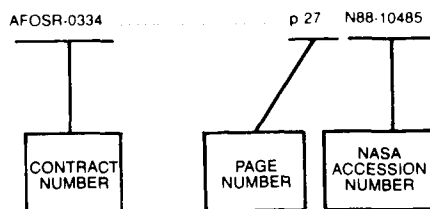
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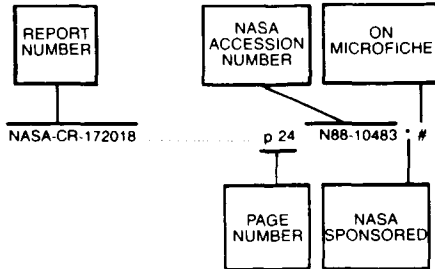


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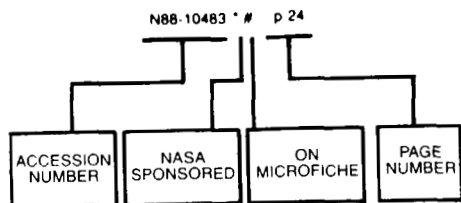
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1. Report No. NASA SP-7011 (315)	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Aerospace Medicine and Biology A Continuing Bibliography (Supplement 315)		5. Report Date October, 1988	
		6. Performing Organization Code	
7. Author(s)		8. Performing Organization Report No.	
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, DC 20546		10. Work Unit No.	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address		13. Type of Report and Period Covered	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract This bibliography lists 211 reports, articles and other documents introduced into the NASA scientific and technical information system in September, 1988.			
17. Key Words (Suggested by Authors(s)) Aerospace Medicine Bibliographies Biological Effects		18. Distribution Statement Unclassified - Unlimited	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 74	22. Price * A04/HC

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NASA-Langley, 1988